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SEVERE EPISTAXIS DUE TO A LEAKING EXTRACRANIAL ANEURYSM OF THE INTERNAL CAROTID ARTERY

P. PACKER, M.MED. (OTOL.) (CAPE TOWN), *Ear, Nose and Throat Department, Groote Schuur Hospital, Cape Town*

It is taught in the ENT Department of this hospital that a child with epistaxis severe enough to warrant admission is not suffering from a purely local cause. Usually such a child will be found to be a case of one of the exanthemata, particularly the prodrome of measles or typhoid or more rarely acute rheumatic fever, acute or chronic nephritis, or one of the blood dyscrasias. The case described below was to some extent exceptional.

R.G., a Coloured male aged 3 years, was admitted on 12 April 1957 with a history of having fallen on his nose 1 week previously with a resulting severe epistaxis. On the morning of admission he had a further sharp epistaxis.

On admission he was not bleeding but looked pale, with a haemoglobin reading of 7 g.%. He was given 250 c.c. of blood and next morning he looked well, with a haemoglobin of 12 g.%.

On examination no general cause for the bleeding was found. He was apyrexial and there was no apparent enlargement of the lymph glands or spleen. A blood smear showed mild hypochromia, 13,500 white blood cells per c.mm. with a normal differential count, no abnormal white cells, and plentiful platelets. The urine was normal. Nothing abnormal was found on anterior rhinoscopy.

On 15 April he had a second severe epistaxis, which ceased spontaneously before the resident house surgeon could get to the child, but 400 c.c. of blood, a third of his estimated blood volume, was needed to resuscitate him. At this stage a diagnosis of secondary haemorrhage due to a fractured nose was still tenuously held.

On 22 April a further sharp epistaxis occurred; the child was shocked and again 400 c.c. of blood was given.

X-ray showed a nasopharyngeal shadow, possibly adenoids or a nasopharyngeal angiofibroma.

On 23 April an examination under anaesthesia showed a red granular protrusion 3 mm. in diameter, surrounded by a pulsatile mass 2·5 cm. long, in the posterolateral nasopharyngeal wall on the right. On careful palpation behind the angle of the jaw more prominent pulsation was felt on the right then on the left. A diagnosis of leaking aneurysm, probably of the right internal carotid, was made.

Blood was kept available, with a cut-down tray, at the bedside. The Wassermann reaction was subsequently found to be negative.

On 29 April Dr. F. van Niekerk, of the Department of Neurosurgery, carried out a right carotid angiogram, which showed an aneurysm of the internal carotid at the base of the skull (Figs. 1 and 2). This was followed immediately by ligation and division of the internal carotid artery just above its origin.

Beyond a post-operative Horner's syndrome on the right side, which has since disappeared, the child showed no neurological signs at all, and when last seen in August 1959 he was mentally and physically normal and active. He had had no further epistaxis and no mass remained in the nasopharynx.

DISCUSSION

On looking back at this case, the diagnosis appears simple, for epistaxis so rapidly exsanguinating could only be due to rupture of a major vessel, aneurysm or angioma. The commonest cause is rupture into the nasopharynx of an aneurysm of the internal carotid; others are rupture of an intracranial internal carotid aneurysm through the sphenoid sinus,[1] and possibly rupture of vessels in a juvenile naso-

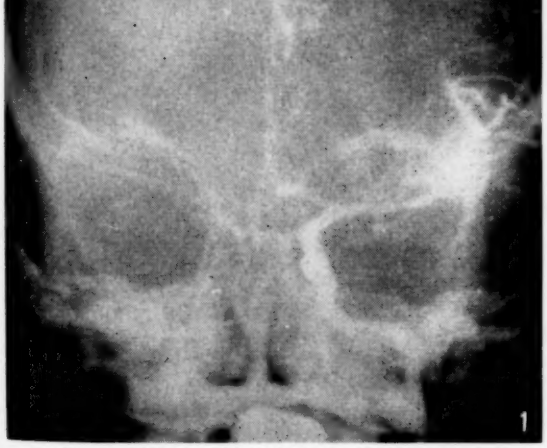

Fig. 1. Right carotid angiogram, anteroposterior.

Fig. 2. Right carotis angiogram, lateral.

pharyngeal fibro-angioma. However, at the time, it did not seem so patently obvious and we felt ourselves lucky in demonstrating the aneurysm without provoking further haemorrhage.

Young,[2] in 1941, described 2 cases and reviewed the previous literature. Apart from war injuries the majority of the cases described were children and followed a typical course. One child developed an acute upper-respiratory-tract infection, diagnosed as scarlatina, and a parapharyngeal abscess followed, with subsequent septic erosion of the carotid sheath. An aneurysm or pseudo-aneurysm formed, which later ruptured into the external auditory meatus or pharynx. Of 28 cases, 11 survived, and in 7 of these ligation of the internal carotid had been necessary.

Silcox and Updegrove[3] reported an arteriosclerotic aneurysm in an adult and reviewed 85 cases of extracranial aneurysm of the internal carotid, of whom all but 2 were under 15 years of age.

Pierini and Agra[4] described a case of aneurysm of syphilitic origin of the petrous portion of the carotid, with probable rupture into the eustachian tube and epistaxis.

The aetiology of the case reported here remains in doubt; there was no history of parapharyngeal abscess, there was no cause for mycotic aneurysm, the Wassermann reaction was negative, and the patient was too young for atheroma. There was a history of trauma, but this may have been conjectural in view of the epistaxis. The suggestion that the child fell with a sharp foreign body in the mouth which penetrated the pharynx was negated by the absence of any scar and by the fact that the aneurysm was above the soft palate. Possibly the aneurysm was congenital.

The commonest treatment has been proximal ligation of the internal carotid artery. The obvious danger is ischaemic cerebral damage. However, McCall *et al.*[5], quoting de Fourmestraux (1906), state that the mortality rate for ligation of the carotid in aneurysm is 13·3% and in haemorrhage 54%. A low mortality in aneurysms, they state, is confirmed by Dandy's figure of 5% (1935) and that of Matas of 4% (1940). Schorstein[6] explains this by showing that in elective ligation of the internal carotid for intracranial aneurysm in young persons the morbidity is low, while in cases where the operation is performed when the patient is shocked, with a slow cerebral circulation, the mortality is extremely high.

The artery is divided between ligatures to avoid pulsation of the proximal segment which may dislodge any thrombus that has formed distal to the ligature.[4]

To try and avoid neurological sequelae, Matas applied pressure over the skin to the carotid and observed the results. We were not prepared to attempt this, in case pressure high enough to occlude the internal carotid caused further haemorrhage, and Dandy's exposure of the artery under local anaesthesia and compression[7] was not considered practicable in a 3-year-old child.

Ligation of the common carotid, allowing retrograde flow to the internal carotid from the external carotid, was felt to be uncertain of cure and yet not without danger.

Resection and graft would hardly have been possible, even in the hands of the most experienced vascular surgeon, owing to the high level of the upper anastomosis.

CONCLUSIONS

1. Leaking aneurysm of the internal carotid artery as a cause of epistaxis, though uncommon, should be considered in sudden gross epistaxis.

2. The treatment is replacement of blood lost, and ligation of the internal carotid artery when the blood pressure is normal again.

3. The possible neurological sequelae may be foreseen and perhaps avoided by prior compression of the internal carotid for several minutes; while an EEG may be used as a monitor.[5]

SUMMARY

A case is described of rupture of a congenital aneurysm of the internal carotid artery at the base of the skull in a 3-year-old child.

Ligation of the internal carotid artery was performed, with subsequent cure and no neurological sequelae.

The condition is discussed and conclusions drawn.

I wish to thank Dr. J. G. Burger, the Superintendent of Groote Schuur Hospital and Dr. D. J. Roux, head of the Department of Otorhinolaryngology for permission to publish this case. Dr. H. Maisels, then the House Surgeon, performed prompt and life-saving transfusion of the child on several occasions.

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REFUGEES FROM THE BELGIAN CONGO

The Acting Chairman of Federal Council has drawn attention to the plight of the many refugees from the Belgian Congo who are now entering the Union. Most of them have suffered considerable hardship and are in financial straits, and the Acting Chairman has asked that members of the Association be requested to show these unfortunate people every consideration and to treat them, when called upon, without fee.

The Secretary of the Association has forwarded a letter embodying the wishes of the Acting Chairman of Council to the Hon. Secretaries of all Branches of the Association. The Acting Chairman's request is republished in this issue of the *Journal* for the benefit of those readers who may not be informed of this matter by their Branches.

South African Medical Journal : Suid-Afrikaanse Tydskrif vir Geneeskunde

EDITORIAL : VAN DIE REDAKSIE

MASTOID OSTEOPLASTY

The development of brilliantly conceived new techniques for restoring hearing, i.e. fenestrations (Lempert[1]), stapes mobilizations (Rosen[4]), and tympanoplasties (Wullstein[2]) has stimulated a great revival of interest in the problems associated with disorders of the middle ear. Aural surgeons are living in an exciting era of development in reconstructive surgery. Intense interest is also being shown by the public who have become aware of the potentialities of the new developments through the influence of the press and popular magazines.

It is fitting that at this stage another new reconstructive aural procedure be described which may finally overcome the last remaining major problem encountered in diseases of the middle ear, i.e. the problem of the mastoid cavity. This has taxed the ingenuity of aural surgeons and defied solution since the classic mastoid operation for chronic middle-ear disease was first described by Stacke in 1893.[3] The mastoid cavity is formed by exenterating the bone to convert the complicated middle ear spaces and the external auditory canal into one large common cavity.

The object of the technique described by Stacke was to eradicate all diseased tissue in the mastoid bone and middle-ear spaces and so prevent extension to the more vital adjacent structures, e.g. the brain, the facial nerve, and the inner ear which contains the balancing and auditory nerve end-organs. Simultaneously it was hoped that the purulent and often offensive discharge from the ear would cease.

Otologists soon realized that this technique gave excellent direct access to structures within the middle ear. The formation of the cavity became the basic step in operations to gain access to the lateral semicircular canal, either to destroy the membranous canal within it (labyrinthotomy for Ménierè's disease), or to expose the membranous canal by creating a controlled fenestra and so restore the hearing (fenestration operation for otosclerotic deafness—Lempert).

In more recent years (1956) Wullstein described the tympanoplastic technique to restore hearing lost due to the disorganization of middle-ear structures by active or past disease. Here, too, the basic step is exenteration of mastoid bone to gain access to these structures.

It is unfortunate that in many cases formation of the mastoid cavity—an integral step in these operations—created major problems of its own. Examples of these problems are the following: Failure of the cavity to heal, large cavities, and stenosed cavities cause a cosmetic and hearing disability. The ear constantly discharges purulent or bloodstained material and the canal has to be plugged with an unsightly wad of cotton wool. In many instances patients with poor hearing who require an aid cannot wear the air conduction type of aid with an insert into the meatal opening of the ear. Finally, inadequate postoperative supervision may lead to such extensive stenosis of the cavity that a second operation to reopen it becomes necessary.

Numerous attempts were made to solve the problem, e.g. methods were used which would facilitate rapid healing of the cavities; free skin grafts, either Thiersch or Woolf, were used as primary or secondary grafts; skin flaps were transposed to line the cavity; temporal muscle was used as a flap; and mastoid bone chips and diced cartilage were used to fill in large cells exposed in the cavity.

Attempts were also made to develop techniques which obviate the necessity to form a mastoid cavity but still serve the same purpose as the operation described. Thus the 'atticotomy' operation was devised by Tumarkin. By removing the bone of the attic area only he avoided constructing a large cavity. Wullstein's school attempts to remove as little bone as possible when doing tympanoplasties.

Unfortunately this does not solve the problem. Wherever the disease is extensive and the bone cellular, the formation of a large cavity is unavoidable. It is also unavoidable when carrying out the fenestration operation. In this issue of the *Journal* a method is described which allows the surgeon to remove as much bone as is essential without having to worry about the size of the cavity formed. After the mastoid operation and after fenestration or tympanoplasty, autogenous cancellous bone grafts taken from the iliac crest are introduced into the remaining cavity. In this way the cavity is completely obliterated, the contour of the external auditory canal is restored, and the canal is provided with a healthy skin lining by the construction of specific skin flaps.

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AUTOGENOUS BONE GRAFTS

It is generally believed that Duhamel[1] in 1739 made the first scientific approach to the problem of osteogenesis. His work was reported in 1742. He placed silver wires subperiosteally and found, weeks later, that they were covered by bone. He believed that this new bone was produced by the osteogenic property of the periosteum. Ollier,[2] starting in 1858, carried out many experiments and from these he concluded that transplanted bone and periosteum remained alive and, under proper conditions, became osteogenic. The battle of the role of the periosteum in osteogenesis and the fate of transplanted bone raged throughout the latter half of the nineteenth century and into the twentieth century. The opposing schools maintained that the periosteum is not essential because the bone-graft survives only as a scaffold and is merely osteoconducive and not osteogenic.

During the past three decades bone-grafting in orthopaedic surgery has become a universally accepted practice, and many surgeons and experimentalists have reported large series of cases using homogenous bone, cadaveric bone, and autogenous bone (Wilson,[3] Lloyd-Roberts,[4]

Peer,[5] Converse and Campbell[6]). It is agreed that the use of cadaveric bone is not satisfactory. Homogenous bone is not as safe as autogenous bone and the rate of union is slower in some cases. In the main the vast majority of orthopaedic surgeons have employed massive cortical grafts. Cortical bone consists of a mass of densely calcified tissue containing tortuous Haversian systems with a few bone cells at their inaccessible distal ends. For mechanical reasons, therefore, very few living bone cells in the transplant can be expected to survive, since the dense bone precludes the establishment of early nutrition. Under these conditions a transplant of cortical bone may be expected to die, and later it is replaced from those few islands which have managed to survive or, alternately, by the ingress of live bone cells from the living bone with which it is in contact.

Mowlem[7,8] first focussed attention on the use of autogenous chip grafts in the closure of bone defects in the jaw and elsewhere. His valuable contributions indicate that cancellous bone grafts can survive if placed in a vascular bed. It may be assumed that with a cancellous transplant a much greater proportion of the bone cells find nutrition from serum and tissue fluids until the capillaries invade the spongy bone. The rapidity of the new cortex formation and the very high tolerance to infection of the grafts, compared with the usual cortical grafts from the tibia, point to early vascularization of the graft followed by cellular activity of the transplant. Neither radiologically nor histologically is there any apparent difference between the adherent or non-adherent graft, so that the question of absorption followed by reconstitution from existing bone cannot arise.

Mowlem's work has led to the modern treatment of non-union in long bones with autogenous cancellous strips obtained from the iliac crest. This type of bone grafting results in more rapid union and there is no sequestration of the grafts in the presence of mild infection. In this issue of the *Journal* an article is published in which Schiller and Singer describe an operation in which they utilize these principles to combat the numerous disadvantages associated with a residual mastoid cavity after the operations of fenestration, tympanoplasty types 2 - 5, and modified and radical mastoid operations.

In a combined synchronous operation called mastoid osteoplasty, cancellous strips of bone are used to obliterate the mastoid cavity after preparing a vascular bed. The early results are encouraging and radiologically integration of the grafts appears to have occurred after three months. The ultimate fate of the graft is not known at present, but the rapid healing with minimal dressings and the relatively normal appearance of the external auditory canal are distinct advances. It is hoped that the authors will publish a further follow-up of their cases at a later date.

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ONRUSTIGHEID EN ONSEKERHEID IN DIE MEDIESE PROFESSIE

Ons leef in 'n tyd waarin daar op baie gebiede van die lewe 'n gevoel van onrustigheid en onsekerheid is. Hierdie gevoel van onrustigheid en onsekerheid is nie net in ons eie land waar te neem in die politieke en maatskaplike en finansiële lewe nie, maar dit is ook aanwesig in baie ander lande—waar dit sowel op die nasionale as die internasionale vlakke tot uiting kom. Vaste waardes en gebruike is aan die verander en aan die kantel. Gevestigde opvattinge word gewysig, en die hele milieu van ons geestelike en praktiese bestaan het meer ‚vloeibaar' geword.

In hierdie golf van onrustigheid wat oor die wêreld trek, is die mediese professie en die mediese praktyk ook betrek. Dit sou dus goed wees om op hierdie stadium vir onsself die vraag te stel: Wat is die faktore wat aan die grond lê van hierdie veranderende omstandighede sover dit die beoefening van die geneeskunde aangaan, en waar staan ons as 'n professie ten opsigte van die basiese waardes?

Een van die ingrypende en diepdringende veranderinge op die gebied van die beoefening van die medisyne, is die feit dat die basiese patroon van geneeskundige dienste heeltemal verander het. Soos ons almal weet is die gesinsdokter—soos hy bekend was aan vroeëre geslagte—aan die verdwyn. Mediese dienste word al meer gelewer teen die agtergrond van spanne dokters in klinieke en hospitale, en op die grondslag van hulp- en versekeringskemas. Aangesien die mediese kennis en die meegaande tegnieke so geweldig uitgebrei het, en aangesien die lewenskoste in die algemeen (en dus ook van mediese dienste) 'n steeds stygende kurwe vertoon, is die veranderende patroon van mediese dienste eintlik onvermydelik.

Vir die individuele dokter, soos vir die individuele pasiënt, skep dit egter besondere probleme. 'n Sekere mate van sekuriteit, wat die dokter betref, wat gegrond was op sy persoonlike verhouding teenoor die mense wat hy bedien, moet verdwyn. En die pasiënt moet hom skik na die anonimiteit van groot organisasies.

Ook op 'n ander vlak het die patroon van mediese dienste radikale veranderinge ondergaan. Ons dink hier byvoorbeeld aan die opkoms van die ‚spesialisme'. Weer moet ons sê dat dit moeilik te bedink is hoe die stelsel verander kan word. Tog word die mededingende faset van die mediese praktyk hierdeur skerp beklemtoon, veral as ons dit in ag neem dat nagenoeg een kwart van al die geneeshere in ons land spesialiste is en dat daar soms veertig of meer spesialiste *in dieselfde vakgebied* in dieselfde betreklik beperkte omgewing praktiseer. Onrustigheid en onsekerheid spruit vir baie dokters uit dié stelsel voort en hulle kom gedurig te staan voor die dilemma van te moet kies tussen die bevrediging van verdere studies en die noodsaak van 'n gevestigde praktyk.

Ons het alreeds indirek verwys na die stygende koste van mediese dienste. Orals oor die wêreld en op alle gebiede is daar 'n groot styging van die basiese lewenskoste. Hierdie faktor, tesame met die kwantitatiewe en kwalitatiewe toename in die aantal en doeltreffendheid van mediese apparaat en middels, het daartoe gelei dat die gewone man geen ander keuse het nie as om aan die een of ander soort hulpfonds of versekeringskema te behoort. Hierdie omstandigheid, wat *ook* onvermydelik is, dra ook sy deel by tot die gevoel van onrustigheid en onsekerheid, aangesien daar

altyd die bedreiging van onpersoonlike sosialisasie van mediese dienste is, of die onderworpenheid van dokters en pasiënte aan die didaktuur van fondse en reëls.

Onder al hierdie omstandighede het die status van die mediese professie baie in die gedrang gekom. Dit is dus noodsaaklik dat ons as 'n professie by herhaling en vernuwing ons eie uitganspunte en waardes moet hersien. Dit is goed om te weet dat die ideaal van diens nog so sterk aanwesig is by so baie dokters. Dit is ook goed om te weet dat die lede van die mediese professie, individueel en gesamentlik, meer werk in ere- en niebetaalde hoedanighede doen as die lede van baie ander professies. Aan die anderkant moet ons egter nie ons oë sluit vir die gedurige bedreigings van oorkommersialisasie van die beroep en van meganisasie en onpersoonlikheid in ons menslike verhoudinge nie.

Die mediese professie moet dus die uitdaging van die veranderende omstandighede en waardes in 'n veranderende wêreld aanvaar en op so 'n manier verwerk dat sy status as 'n vereniging van geleerdes en van professionele persone wat 'n spesiale diens het om te lewer, onaangetas bly.

MASTOID OSTEOPLASTY USING AUTOGENOUS CANCELLOUS BONE: A NEW PROCEDURE

A. SCHILLER, D.L.O., F.R.C.S. (EDIN.), *ENT Surgeon*, and MARTIN SINGER, F.R.C.S. (ENG.), *Orthopaedic Surgeon*, *New Somerset Hospital, Cape Town*

The exenteration of the mastoid bone to form a cavity communicating with the external auditory canal is an integral step in all modified and radical mastoid operations and in fenestration and tympanoplasties, types 2 - 5. It is unfortunate that this procedure, which is an essential feature of these operations, is also responsible for most of the post-operative complications, involving the following undesirable features:

1. *Prolonged after-care.* After operation the patient often has to attend repeatedly for a long time, to allow the cavity to become completely epithelized, or lined by a healthy layer of fibrous tissue, and yet retain its saucerized shape. These attendances are sometimes distressing, especially for children.

2. *Aural discharge.* Many of the cavities fail to heal completely, despite the most diligent and prolonged after-care, and a discharging ear remains. Patients with a discharging ear after fenestration or tympanoplasty are invariably dissatisfied, especially if there has been no improvement in their hearing.

3. *Hearing-aid problems*, as follows:

(*a*) The acoustic qualities of the external auditory canal are altered when a large mastoid cavity is constructed, so that if a hearing aid is required, the patients find that although the sound is amplified it is distorted.

(*b*) It is seldom satisfactory to mould a hearing-aid insert into an ear with a large mastoid cavity and an enlarged meatal opening. When the ear mould fits loosely, a disconcerting whistling noise is emitted from the hearing aid.

(*c*) Stenosis of the meatus is a complication not often seen, but when it does occur it makes it difficult to carry out aural toilet and often impossible to fit a hearing-aid insert, should that be required.

(*d*) In the presence of a discharging cavity, it is undesirable to fit a hearing-aid insert.

Hitherto surgeons have directed their attention towards obtaining a dry, trouble-free cavity, which can at all times be readily inspected, though despite the use of skin grafts many cavities still remain wet and troublesome. The functional relationship of the mastoid cavity to the hearing properties of the affected ear has been completely neglected. This would be unimportant if the operation performed restored serviceable, unaided hearing, but where a hearing aid is required this relationship assumes great significance.

A NEW CONCEPT TO OBVIATE THE DISADVANTAGES OF THE MASTOID CAVITY

It was felt that if the mastoid cavity could be completely obliterated it should be possible to obviate these difficulties and snags. The cavity must perforce be created, but it seemed feasible to fill in the defect with suitable bone grafts and skin flaps. These would serve to reconstruct the petromastoid, the posterior bony canal wall and the outer attic wall and provide a complete, healthy lining to the re-formed external auditory canal.

A one-stage procedure was devised to incorporate these principles. In the planning of this procedure, the following factors required consideration: (*a*) Type of bone graft, (*b*) nutrition of the graft, (*c*) the effect of infection on the graft, and (*d*) provision of skin cover for the portion of the external auditory canal re-formed by the graft.

It was decided that the most suitable graft for this purpose would probably be strips of autogenous cancellous bone obtained from the iliac crest. The cancellous strips are nourished by tissue fluids for 72 hours before they are revascularized; moreover, it is known from bone-grafting procedures on the mandible and elsewhere that cancellous strip grafts will survive even in the presence of mild infection.

Previous attempts have been made to introduce grafts into the cavity—not to obliterate the entire cavity, but to fill in large cells exposed during exenteration of the bone. Mastoid bone chips or diced cartilage have been used,[1] but these are unsatisfactory tissues for grafting because *inter alia* they cannot safely be used if infection is present.

It is important to provide cancellous grafts with a vascular bed. This can to some extent be ensured by the judicious use of pedicle flaps constructed from the soft tissue which covers the auricle and the postauricular area, and from the lining of the membranous and bony auditory meatus. These flaps help to furnish a blood supply for the grafts and provide the newly-constructed external auditory canal with an epithelial lining which should survive because each flap has a good blood supply. The nature of the operation determines the type of flap to be used. The following types have been found useful:

1. *Postauricular flap* (Figs. 1 and 2). This flap was constructed by Beales and Hynes[2] to line the mastoid cavity. In reconstructing old mastoid cavities, this flap provides the

necessary nutrition and skin covering for the bone grafts forming the reconstructed lateral surface of the mastoid and the posterior wall of the external auditory canal.

2. *Auricular flap.* This constitutes the usual flap of soft tissues, which includes the postauricular skin, the entire auricle and the postero-superior portion of the membranous meatus. It is used in all modified and radical mastoid operations and tympanoplasties, if the approach is by the postauricular route, and nourishes the bone grafts forming the lateral surface of the mastoid and upper part of the bony external auditory canal.

3. *Fenestration flap.* This is constructed from the skin lining the posterior, the superior, and part of the anterior meatal wall, and is hinged on the tympanic membrane.

The auricular flap and the fenestration flap may be used for modified radical mastoids and tympanoplasties if *no* attic perforation or subtotal perforation of the drum is present.

4. *Double hinge flaps*, which act like swinging-gates (Figs. 3 and 4). To construct these, the skin lining the posterior, the superior and a portion of the anterior bony meatal walls is freed as far as the region of the tympanic sulcus. At this level, it is severed circumferentially from 12 o'clock to 6 o'clock. The hinge flaps are formed by bisecting this elevated sheet of skin. As shown diagrammatically, the anterior flap hinges at the junction of the anterior and inferior walls, and the posterior flap on the inferior wall of the external auditory canal. When replaced these cover the bone grafts forming the superior and posterior bony walls of the external auditory canal. These flaps may be used in conjunction with postauricular or auricular flaps in all modified and radical mastoidectomies and all tympanoplasties.

PROCEDURE

Pre-operative Preparation

1. *Radiographs of mastoids.* Radiographs indicate the extent of sclerosis. If there is dense sclerosis, bone grafting may not be indicated, because then the cavity is usually small and not troublesome.

2. *Bacteriological study and antibiotics.* Where the middle ear or external auditory canal is infected, aural swabs are required for culture and sensitivity tests. The appropriate antibiotic is administered orally or intramuscularly and also instilled locally for 48 hours before the operation. Where no infection is present, a broad spectrum antibiotic such as tetrex is used 48 hours pre-operatively.

3. *Skin preparation.* The mastoid area and the ipsilateral or contralateral hip and thigh are prepared in the ordinary manner.

Technique of Operation

Stage 1: *Approach.* It is better to use the postauricular approach than the endaural, because it is essential to preserve all the skin and soft tissues of the meatal opening and external auditory canal, which are necessary for the formation of the skin flaps.

Stage 2: *Formation of skin flaps.*

Stage 3: *Exenteration of bone.* The methods of exenteration of the mastoid bone have been well described by many authors. The only variation in this procedure is to avoid exposing the dural plate and the thin bone covering the lateral sinus. This bone, being compact, has a poor blood supply and therefore inadequate regenerative powers.

Stage 4: *Cancellous strip grafts.* The ipsilateral or contralateral iliac crest is approached *via* a 3-inch incision extending posteriorly and slightly laterally from the anterior superior iliac spine. The iliac crest is then denuded of periosteum for 2 - 2½ inches. Within this limit, 1 horizontal cut and 2 vertical cuts (½ inch long) are made with an osteotome through the outer cortical layer of cancellous bone and a 'lid' of the crest is swung medially (Fig. 5). Now 2 further vertical cuts (2½ - 3 inches) are made with an osteotome within this limit through the outer cortical layer only, and this flap of cortical bone, which is hinged below, is pushed laterally, exposing the middle cancellous layer (Fig. 6). Then 2 or more strips of cancellous bone, measuring 1½ inches by 1/8th of an inch, are removed with a sharp osteotome and are later cut and shaped into further strips as required for the cavity (Fig. 7). This is easily done with a small, sharp, slightly angled pair of bone-cutters. These strips are placed in a bowl containing penicillin solution, until required. The 'lid' and the lateral cortical flap are replaced and the wound is carefully closed in layers after all bleeding has been controlled.

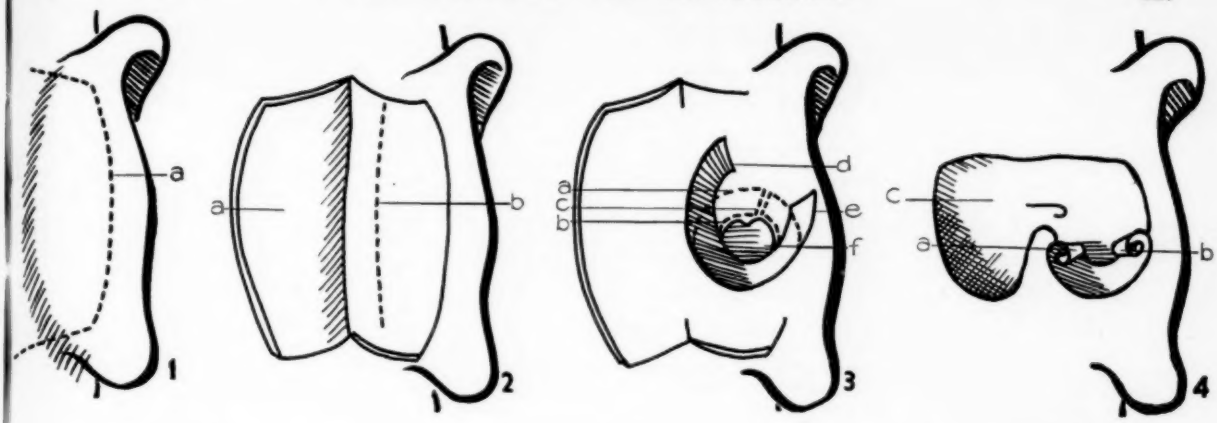
Stage 5: *Utilization of the cancellous bone strips.* Two methods of inserting the strips of cancellous bone have been found suitable. Method A (depicted diagrammatically in Fig. 8) is used for reconstruction of the petromastoid and the posterior wall of the bony canal. Method B (Fig. 9) is used for reconstruction of the petromastoid, the posterior wall of the bony canal, and the outer attic wall. When introducing the bone grafts, it is desirable (1) to avoid crushing or pulping the strips, which destroys the osteogenic cells and the excellent natural scaffolding for invasion of new bone-forming elements from the host bone; (2) to place the strips so that the largest possible surface comes into contact with the host bone; (3) to avoid inserting too many strips of bone, because if an excess is used (*a*) too narrow an external auditory canal is created and (*b*) the skin flaps do not entirely cover the exposed surfaces of the grafts; and (4) to place the fenestration flap or the tympanic free skin graft in position before inserting the bone strips.

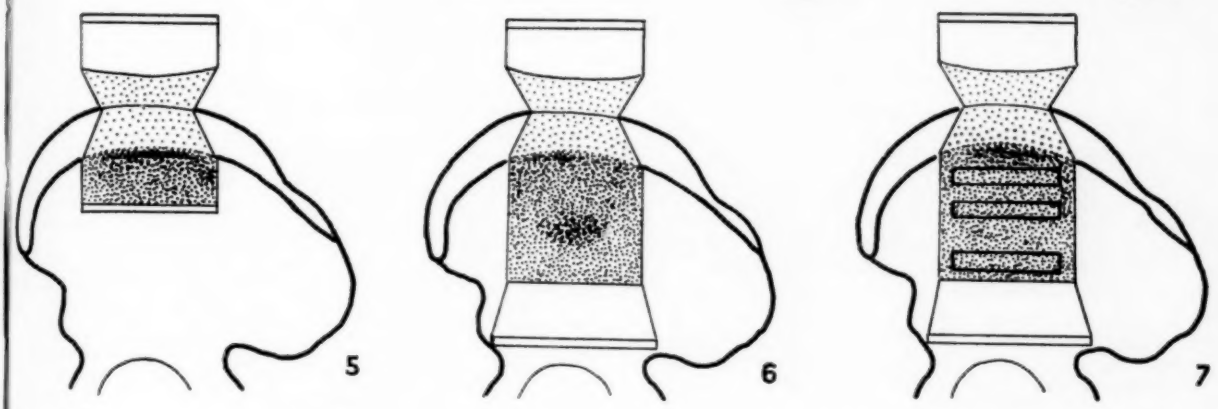
Stage 6: *Replacing the skin flaps.* The flaps are carefully replaced to cover all the exposed surfaces of the graft. Free skin grafts used to cover any of the bone strips do not survive. The external auditory canal is then loosely packed with sterospon and paraffin gauze strips.

Finally, the postauricular incision is sutured. The denuded areas on the postauricular surface can be covered with free split-thickness grafts taken from the thigh or inner aspect of the arm.

Post-operative Treatment

Antibiotic therapy is continued until the sutures are removed on the 7th post-operative day. The meatal gauze pack is removed, and the liquefied or semi-liquefied sterospon is evacuated by gentle sucking and/or mopping. A general anaesthetic is not required for this. Afterwards 1·5% neocortef-acetate drops are instilled into the meatus twice a day. On the 12th post-operative day (with children), or the 14th (with adults), sutures at the iliac crest are removed and the patient can then commence walking. Radiological examinations are made at monthly intervals until it is evident that the graft has become an integral part of the mastoid bone.





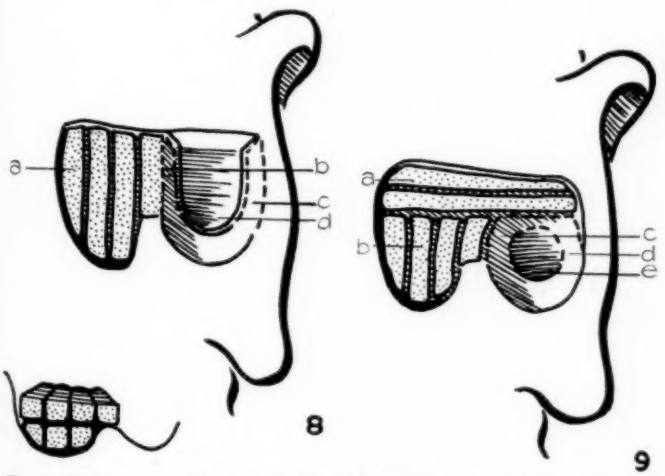


Fig. 1. Line of incision (*a*) for the postauricular flap.

Fig. 2. Postauricular flap (*a*) formed by separating the skin and subcutaneous tissue from the posterior surface of the auricle. Incision (*b*) extends through the subcutaneous tissues down to the mastoid bone.

Fig. 3. The skin lining the posterior, superior and anterior wall of the external auditory canal is incised (*a*) at the level of the lateral surface of the mastoid. Within the confines of the line of incision the skin of the meatal wall is carefully separated down to near the tympanic sulcus, where it is incised (*b*) circumferentially. The large flap of skin formed is bisected (*c*) to construct the anterior (*e*) and posterior (*d*) hinge flaps. The drum or promontory is marked (*f*).

Fig. 4. The hinge flaps (*a*) and (*b*) are rolled out of the way and the bone is exenterated to form the mastoid cavity (*c*).

Fig. 5. The 'lid' formed by the iliac crest and outer cortical layer has been raised and pushed medially.

Fig. 6. The outer cortical layer is hinged inferiorly and pushed laterally, exposing the middle cancellous layer.

Fig. 7. Cancellous strips removed from the middle layer.

Fig. 8. Strips of cancellous bone (*a*) are inserted lengthwise between the tegmen and the lower margin of the mastoid cavity. This reconstructs the petromastoid and the posterior bony wall of the canal, which becomes lengthened by the width of the attic. The strips are not squeezed into apposition and the gaps between the strips are not filled in with bone chips. The posterior hinge flap (*b*) covers the reconstituted posterior bony canal wall, and the anterior hinge flap (*c*) covers the anterior attic wall. The full-thickness skin graft (*d*) forms the drum and extends onto the medial and superior attic walls.

Fig. 9. Strips of cancellous bone (*a*) are introduced lengthwise, extending from the sinodural angle to the anterior attic wall. This reconstitutes the outer attic wall and portion of the mastoid cavity. Strips (*b*) are then inserted lengthwise at right angles to (*a*) to reconstruct the remainder of the mastoid cavity and the posterior bony canal wall. The hinge flaps (*c* and *d*) are unfurled to cover the exposed surfaces of the strips forming the posterior and superior walls of the canal. The full-thickness skin grafts used for the tympanoplasty are shown as (*e*).

TABLE I. POST-OPERATIVE RESULTS

	Case 1	*Case 2*	*Case 3*	*Case 4*	*Case 5*	*Case 6*	*Case 7*
Operation	Tympano-plasty. Mastoid and reconstruction. Method B.	Fenestration. Recon-struction. Method A.	Tympano-plasty. Recon-struction. Method A.	Recon-struction of old mastoid cavity	Tympano-plasty. Recon-struction. Method B.	Tympano-plasty. Recon-struction. Method A.	Tympano-plasty. Recon-struction. Method B.
Time of dry and complete epithelization of external auditory canal and attic area	17 days	21 days	27 days	21 days	21 days	21 days	21 days
Post-operative contour of external auditory canal	Normal	Normal in its outer 2/3rds. Inner 1/3rd widened by the inclusion of the attic and part of antrum	Elongated by the inclusion of the attic area	Irregular	Normal	Elongated by the inclusion of the attic area	Normal
Post-operative radiological appearances	Complete integration of bone grafts with the host bone.			Less than 3½ months. Incorporation is proceeding but not complete.			

Contra-indications

In the following conditions the grafting of the mastoid cavity with cancellous bone should not be undertaken:

1. Middle ear infection, associated with complications.
2. Dense, sclerotic mastoid bone. In these cases the eventual mastoid cavity is usually small and not troublesome. Moreover, the avascular sclerotic bone is a poor, unsuitable bed for the cancellous bone strips.

CASE RECORDS

The following are notes on the first 7 cases in which this grafting procedure has been applied. The cases comprise 5 tympanoplasties, 1 fenestration, and 1 old infected cavity following a radical mastoid operation. The post-operative results are shown in the concluding section under the heading 'summary and results' and in Table I. One of us (A.S.) performed the ear operation, including the bone grafting of the cavity, and the other (M.S.) took the grafts from the iliac crest.

Case 1

D.G., Coloured female aged 11 years.

History. Persistent, foul-smelling aural discharge for 4 years.

Examination. Left ear normal. Right ear Malodorous, purulent discharge; pars tensa absent and medial tympanic wall covered with cholesteatomatous debris; conversational voice heard at maximum distance of 1 foot; fistula sign negative.

Diagnosis and conclusion. Cholesteatoma formation in right tympanic cavity resulting in otorrhoea and deafness. Right tympanoplastic operation to be performed and the exenterated mastoid bone reconstructed with autogenous cancellous bone strips taken from iliac crest.

Pre-operative preparation. Although scheduled to arrive 3 days before the operation, the child was only admitted the night before; therefore no preliminary X-ray or bacteriological investigations were possible. A broad-spectrum antibiotic (tetrex, 250 mg. 12 hourly) was prescribed and skin prepared for the mastoid area and contralateral hip.

Operation, 21 October 1959. Pentothal and scoline induction; intubation; gas, oxygen and ether. Small sandbag placed under right buttock to render the iliac crest prominent; head positioned as for mastoidectomy. Towels first placed around hip and then towels for mastoidectomy positioned. External auditory canal and promontory area cleansed and inspected. The skin flaps employed were (*a*) a conventional auricular flap and (*b*) 2 swinging-gate flaps constructed from the skin lining the posterior superior, and portion of the anterior walls of the canal (Fig. 3).

A postauricular incision was made down to bone, avoiding injury to the temporalis muscle. The soft tissues were pushed forwards to expose the lateral surface of the mastoid and the outer attic wall. The external auditory canal was entered by a transverse incision through the skin of the posterior meatal wall. The incision extended circumferentially from 12 o'clock to 6 o'clock, thereby allowing the auricle and soft tissues to be reflected forwards, and the auricle was held there by a retractor without exerting any tension on the skin lining the bony canal down to the tympanic sulcus. By carefully separating the skin lining down to the tympanic sulcus and incising it (Fig. 3) adequate posterior and anterior hinge flaps were constructed.

With gouges, the bone was exenterated as for a radical mastoidectomy. The bone was of the small cellular variety. Extensive infected cholesteatoma was found in the antrum and attic area. This was removed. With a Zeiss microscope (×10 magnification) the middle ear mucosa was inspected and found grossly diseased. Every visible shred of cholesteatoma and diseased mucosa was meticulously removed from the mastoid cavity and tympanum. The stapes and the round windows were isolated and found to be mobile. The eustachian orifice was cleared of a collection of cholesteatomatous debris.

A full-thickness skin graft was taken from the postauricular surface, prepared, and placed in position to complete a type-3 tympanoplasty.

The cancellous bone, synchronously taken from the iliac crest and cut into strips measuring about 1½ inches by 1/8th of an inch, were then removed from the penicillin solution and trimmed to the necessary requirements.

The outer attic wall was first reconstructed by inserting strips lengthwise, extending from the sino-dural angle to the anterior wall. The innermost of these strips rested on the bone of the medial attic wall. The mastoid and posterior bony wall was then rebuilt by inserting strips lengthwise at right angles to the others. The space previously occupied by the antrum and attic was obliterated (Fig. 9).

After inserting the bone strips, the mastoid retractor was released and the auricle replaced in its normal position. Through a speculum inserted into the meatal opening, the positioning of the bone grafts was inspected and size of the external auditory canal noted.

As it appeared satisfactory, the auricle was again reflected and held forwards. The anterior and posterior hinge flaps were unfurled and found to cover the grafts forming the posterior and superior canal walls, except for the small innermost area where the superior wall extended onto the medial wall of the attic. This area was covered by the uppermost portion of the free tympanic graft which had been placed in position before the bone grafts were inserted. The canal was filled with sterospon pledgets soaked in penicillin.

When the auricle was released the soft tissues were observed to cover the grafts forming the lateral surface of the mastoid.

Finally, after the postauricular incision was sutured a small paraffin gauze plug was inserted through the meatal opening for about ½ inch and the usual external mastoid dressing was applied.

Case 2

B.S., Coloured male aged 24 years.

History. Bilateral otosclerosis. Three months previously, right stapes mobilization done; result unsuccessful, and fenestration with reconstruction of the exenterated mastoid and posterior bony canal wall with autogenous cancellous bone strips from iliac crest now advised.

Pre-operative preparation. (1) Radiographs of mastoid showed mastoid structure to be cellular. (2) Audiogram showed 50 decibel loss over all frequencies in both ears. (3) Tetrex, 500 mg. 12 hourly, prescribed and skin prepared for mastoid and contralateral hip area.

Operation, 13 November 1959. Pentothal and scoline induction; intubation; gas, oxygen and ether. A routine fenestration operation was done *via* the postauricular approach. After the tympano-meatal flap had been placed in position over the fenestra, strips of autogenous cancellous bone, synchronously exsected from the iliac crest and soaked in penicillin solution, were trimmed and placed in position to build up the mastoid cavity and posterior bony meatal wall (method A, Fig. 8). No attempt was made to reconstitute the outer attic wall by inserting bone strips. The area was inspected through the meatal opening after the auricle had been repositioned. It was noted that the external auditory canal had a normal-looking contour and that the attic area was easily visible. The reconstitution of the mastoid and posterior bony canal wall appeared satisfactory.

The auricle was again reflected and held forwards by inserting the mastoid retractor. The portion of the fenestration flap lying immediately posterior to the lateral semicircular canal was gently elevated and placed over the surface of the adjacent bone grafts. It only provided skin cover for the grafts forming the upper half of the reconstituted posterior bony canal wall, and to provide skin covering for the lower half, which remained exposed, a rotation sliding flap was constructed from the skin covering the remaining normal part of the posterior canal wall and from the skin of the inferior wall.

Sterospon pledgets and a paraffin gauze plug were placed in contact with the skin flaps to exert gentle pressure. The auricle was replaced in its normal position and the postauricular wound sutured.

Case 3

M.F., Coloured female aged 14 years.

History. Left otorrhoea for 5 years. Hearing poor. Seven years previously a modified radical mastoidectomy had been done on right ear, which still discharged.

Examination. Left ear: Foetid, purulent discharge; tympanic membrane destroyed; skin lining of bony meatal wall soggy and unhealthy; loud voice heard at maximum distance of 6 inches; fistula sign negative. Right ear: Malodorous purulent discharge from a large modified radical cavity, which was filled with cholesteatomatous material. Heard conversational voice up to 2 feet.

Diagnosis and conclusion. Left ear: Cholesteatoma formation, causing destruction of drum and ossicles, and otorrhoea and deafness. Right ear: Non-epithelized mastoid cavity with cholesteatoma formation. Tympanoplasty operation to be performed and mastoid cavity reconstructed with autogenous cancellous iliac strips. The operation was first performed on the left ear (case 3) and, after an interval of 2 weeks, the right ear was operated on (case 4).

Pre-operative preparation. (1) Radiographs of mastoids: 'Left ear—mastoid bone structure small, cellular variety; large, translucent area in antral and attic region suggestive of cholesteatoma formation.' (2) Skin prepared for mastoid and hip areas. (3) Tetrex, 500 mg. 12 hourly, commenced 48 hours pre-operatively.

Operation. As the skin lining the canal was unhealthy, it was decided to prepare a postauricular flap (Figs. 1 and 2) and also, if possible, posterior and anterior hinge flaps (Fig. 3). The post-auricular flap was constructed, but during the preparation of the hinge flap the skin lining the antero-superior portion of the canal wall disintegrated. This resulted in the formation of a long posterior flap and very short anterior flap.

The exenterated bone was cellular. An extensive infected cholesteatomatous cast was removed from the antrum and the attic area and a large mastoid cavity resulted. After careful removal of cholesteatoma-bearing areas under ×10 magnification, a tympanoplasty type 4 was completed.

Autogenous cancellous bone strips soaked in penicillin solution were trimmed and inserted into the mastoid cavity and attic area (method B, Fig. 9). When the hinge flaps were replaced they did not adequately cover the exposed surface of the grafts forming the superior wall of the bony canal.

The bone strips were then removed and repositioned to reconstruct the mastoid cavity and posterior bony canal wall only (method A, Fig. 8), and the attic area was left in its exenterated state. It was then found that the posterior flap completely covered the strips forming the elongated posterior canal wall. The small anterior flap covered the anterior attic wall. This left the exposed bone of the medial and superior walls of the attic without an epithelial covering and, to provide this covering, a portion of the postauricular flap was excised, making it long enough not only to form the tympanic membrane, but also to extend onto and cover the medial and superior attic walls (Fig. 8).

The reconstituted canal was well formed but elongated, and completely lined with an epithelial covering.

The canal was filled with sterospon pledgets soaked in penicillin. The auricle was sutured into position and a short paraffin gauze plug was inserted through the meatal opening.

Finally, a split-thickness graft was sutured to the raw post-auricular surface.

Case 4

M.F., Coloured female aged 14 years (same child as case 3).

History, etc. See case 3.

Pre-operative preparation. Same as in cases 1 and 3.

Operation. As there was no skin present to form anterior and posterior hinge flaps, the approach was by the postauricular route with the construction of a postauricular flap (Figs. 1 and 2).

The old mastoid cavity was carefully cleansed of all diseased tissue and the medial wall of the tympanic cavity prepared for tympanoplasty type 4.

Autogenous cancellous bone strips synchronously removed by one of us (M.S.) from the iliac crest, were trimmed and inserted into the cavity to reconstruct the mastoid bone and the posterior bony wall of the external auditory canal (method A, Fig. 8). The outer attic was not reconstructed.

The postauricular flap was positioned to cover the exposed surfaces of the bone grafts. A redundant portion of this flap was used as a free graft to complete the tympanoplasty.

Sterospon and paraffin gauze were placed in contact with the free skin graft and skin flap to exert gentle pressure.

The postauricular opening was closed by carefully suturing the subcutaneous soft tissues of the auricle, at its free margin, to an area on the transposed skin which had been denuded of its surface layer of dermis along the site corresponding to the original area of attachment of the auricle (Beales and Hynes[2]).

The large raw area on the posterior surface of the auricle was covered with a split-thickness graft, which was sutured into position.

Case 5

M.R., Coloured female aged 12 years.

History. Right chronic suppurative otitis media for 3½ years. *B. pyocyaneus*, sensitive to polymixin, was the organism responsible. The ear continued to discharge despite antibiotic treatment.

Examination. Right ear: Purulent discharge; pars tensa completely destroyed, and promontory covered with oedematous red granulation tissue. Conversational voice heard up to 2 feet.

Conclusion. Right tympanoplasty to be performed and the petromastoid, the posterior bony canal wall, and the outer attic wall reconstituted by inserting autogenous cancellous bone strips taken from iliac crest (method B, Fig. 9).

Pre-operative treatment. (1) Radiographs of mastoids: 'Left ear—large radical mastoid cavity; right ear—the mastoid bone structure is of the small cellular variety; no evidence of bone destruction noted.' (2) Bacteriological report on aural swab: '*B. pyocyaneus*, sensitive to polymixin only.' (3) Oral tetrex, 500 mg. 12 hourly, and local instillation of polymixin solution, commenced 48 hours before the operation.

Operation. A postauricular approach was used and a post-auricular flap and 2 swinging-gate hinge flaps were constructed.

The exenterated mastoid bone was found to be of the small cellular variety and the antrum and attic were completely filled with oedematous fibrous tissue. All diseased tissue was carefully removed under ×10 magnification from the antrum, attic and tympanic cavity. As a mobile stapes was isolated, tympanoplasty type 3 was completed in the conventional manner.

The prepared strips of autogenous cancellous bone synchronously taken from the iliac crest were trimmed and inserted into the mastoid cavity to reconstruct the outer attic wall, the petromastoid, and the posterior bony canal wall (method B, Fig. 9).

After inspecting the contour of the reconstructed external auditory canal, the hinge flaps were unfurled and positioned. Sterospon pledgets were packed into the canal and a short length of paraffin gauze introduced through the meatal opening, and the operation was completed by suturing the postauricular incision.

Case 6

G.V., Coloured female aged 14 years.

History. Chronic right suppurative otitis media for 7 years.

Examination. Thick, purulent discharge. Drum completely absent and medial tympanic wall covered with granulations. Conversational voice heard up to 6 inches.

Conclusion. Tympanoplasty type 3 to be performed and the petromastoid and the posterior bony canal wall reconstructed by inserting autogenous cancellous bone strips taken from the iliac crest.

Pre-operative treatment. (1) Mastoid radiographs: 'Right—bone sclerotic; left—cellular'. (2) Tetrex, 500 mg. 12 hourly, commencing 48 hours pre-operatively.

Operation. By the postauricular approach, an auricular flap and 2 swinging-gate hinge flaps were constructed. The posterior hinge-flap was made longer than the anterior so that it would adequately cover the reconstructed elongated posterior bony canal wall.

The mastoid bone, which was sclerotic, was exenterated. A small antrum and attic contained cholesteatoma. This was carefully removed under ×10 magnification. A free, full-thickness skin graft was prepared to form the drum and to cover the medial and superior attic walls. A type 3 tympanoplasty was completed.

The autogenous cancellous bone strips taken from the iliac crest were prepared and inserted into the mastoid cavity to reconstruct the petromastoid and posterior bony canal wall (method A, Fig. 8). After inspection of the contour of the reconstructed external auditory canal, the hinge flaps were unfurled and positioned.

Sterospon and paraffin gauze packing was inserted to exert gentle pressure and, finally, the postauricular incision was sutured.

Case 7

O.P., Coloured male aged 27 years.

History. Persistent malodorous discharge from the left ear for 7 years. Slow deterioration of hearing.

Examination. Large attic perforation was present and pars tensa was seen to be adherent to medial tympanic wall. Conversational voice heard up to a distance of 3 feet.

Conclusion. Tympanoplasty operation to be performed, and the exenterated mastoid bone reconstructed by introducing autogenous cancellous bone strips from the contralateral iliac crest.

Pre-operative treatment. (1) Mastoid radiographs: 'Left ear—the bone shows evidence of sclerosis; right ear—extensive pneumatization of the mastoid bone.' (2) Tetrex, 500 mg. 12 hourly, commenced 48 hours before operation.

Operation. After cleansing and inspection of the external auditory canal, it was decided to create a conventional auricular flap and two swinging-gate hinge flaps.

The exenterated bone was of the small cellular variety. A large mastoid antrum and wide attic were found filled with cholesteatoma and oedematous infected granulations. The diseased tissue was carefully removed and a tympanoplasty type 3 was completed.

Strips of autogenous cancellous bone soaked in penicillin, synchronously taken from the contralateral iliac crest, were trimmed and introduced into the exenterated area to reconstruct the outer wall, the petromastoid, and the posterior bony canal wall (method B, Fig. 9).

After positioning of the hinge flaps, the canal was packed with sterospon and the postauricular wound was sutured.

SUMMARY AND RESULTS

1. A new osteoplastic reconstructive procedure performed on the ear has been described. Seven cases are presented—5 tympanoplasties, a fenestration and an old, infected radical mastoid cavity.

2. In each case, autogenous cancellous bone strips taken from the iliac crest were inserted into the mastoid cavity to reconstruct the exenterated petromastoid and the bony walls of the external auditory canal. Skin flaps were fashioned to provide the epithelial covering.

3. Thus far, in every instance, the mastoid bone has been completely reformed, with obliteration of the mastoid cavity. The normal contour of the external auditory canal has also been restored (Table I).

4. The post-operative course and end-results in this series of cases showed several striking advantages:

(*a*) The sutures and plugs were removed painlessly without a general anaesthetic.

(*b*) Healing took place at a rapid rate with a minimum amount of local treatment. Gentle mopping of the canal was only performed at weekly intervals and the canal was completely dry and epithelized 3½ weeks after operation in all cases. The multiple visits and painful local toilet to the mastoid cavity, often over a prolonged period, were completely obviated.

(*c*) The final result is a dry, relatively normal-shaped, and completely epithelized external auditory canal. In 4 cases the canal was a little elongated by the inclusion of the attic area.

(*d*) In the first 3 cases, radiographic evidence of successful integration of the bone grafts with the host bone was present 3 months after operation (Table I). In the remaining cases, too short a period has elapsed for the final radiographic assessment to be made. There has been no evidence of sequestration of the bone grafts.

5. Post-operative pain was experienced in the iliac crest wound but this disappeared when the stitches were removed. No undesirable sequelae resulted from this wound.

We have much pleasure in recording our thanks to Prof. J. H. Louw, Groote Schuur Hospital, Cape Town, for his encouragement. Our thanks are also due to Dr. G. J. Joubert, Superintendent, New Somerset Hospital, for allowing us to publish the cases. We wish to acknowledge our gratitude to Dr. K. Brauer for the many special radiographs he took and for his help in the interpretation of the various stages of graft integration. We are also indebted to the anaesthetists, Drs. N. C. Smiedt, J. Levin, M. Friedland and N. M. Shear. Miss A. Schweitzer and Mr. Dan Coetzee are responsible for the line drawings.

ADDENDUM

Since the completion of this paper a further 5 patients have undergone the operation of mastoid osteoplasty. The post-operative course thus far has been the same as in the 7 cases recorded above.

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PILONIDAL SINUS

I. COLL, M.B., B.CH. (RAND), F.R.C.S. (ENG.), F.R.C.S. (EDIN.), *Registrar, King Edward VIII Hospital, Durban*

A pilonidal sinus is one containing hair and, although the condition is most often thought of as a sinus in the mid-line in the sacrococcygeal area, numerous reports have been published of similar sinuses elsewhere in the body. It was probably the realization that the condition did occur in other anatomical regions that stimulated further investigation into the aetiological factors concerned. However, the absence of these lesions until adult life, their multiple nature in some cases, their occurrence at various sites (as in the webs of fingers of barbers, and in the perineum and axilla), and the absence of growing hair in the sinus, gave rise to reasonable doubt whether the lesion had a developmental origin.

The main purpose of this communication is to indicate a modified method or primary suture which has been successful in 20 cases. The literature on the aetiology, pathology, diagnosis and treatment is also reviewed.

The theories concerning the origin of pilonidal sinuses fall under the opposing headings of congenital and acquired.

THEORIES OF CONGENITAL ORIGIN

Embryology[1-3] The primitive streak is formed in the 2nd or 3rd week of foetal life. Shortly afterwards a fold appears on each side of it and the medullary (or neutral) groove is formed between the two folds. These folds develop slowly and incline towards each other in the dorsal mid-line until fusion takes place. This converts the neural groove into a canal, which becomes the central canal of the spinal cord, and the cells surrounding it become the central nervous system of the full-term foetus. During this process of development the spinal vertebrae are forming from primitive mesoderm. The medullary canal closes first in its cranial part and spreads downwards to close finally at its caudal end.

Unequal growth at the distal end of the spinal column induces a bend in the form of a loop. A connection remains between the skin and the distal end of the cord. This connection gives rise to masses of cell nests which contain cavities lined with pavement epithelium. Normally these cords disappear by the 6th month.

(*a*) *Neurogenic*

Hermann and Tourneaux[4] in 1887 and Mallory[5] in 1893 supported the view that, after separation of the spinal cord from the superficial tissues, a process of epithelial tubes persists for a time at the point of previous connection of the neural axis with the skin, forming a vestigial remnant of that connection.

Gage,[1] from observations of serial sections of embryos, substantiated the neurogenic basis for these abnormalities and concluded that pilonidal cysts form from the medullary vestiges and the dimple from the attachment of the caudal ligament.

Sinuses communicating with the vertebral coverings of the sacral canal have been reported.[6] It was stressed that meningitis was a common and early sequel of this abnormal condition, but Aird[7] and Kooistra[8] both point out that the opening in the spinal cord is usually at a higher level than in the case of a pilonidal sinus.

Oehlecker[3] held that in the early embryo the lower three or four vertebrae disappear and become the caudal ligament, which is attached to the skin. As the caudal vertebrae undergo rapid growth, the overlying skin is unable to maintain the same rate of growth, and is displaced upwards and posteriorly drawing with it the tip of the caudal ligament. By the 4th or 5th month, the skin which originally covered the tip of the coccyx lies over the 3rd and 4th caudal vertebrae; this site is thin, hairless and vascular and is called by Oehlecker the 'sacral bald spot'. The caudal ligament is attached to the skin, exerts a pull on it, producing a depression, the coccygeal dimple.

(*b*) *Ectodermal Invagination*

Fox[9] studied serial sections of embryos and refuted the neurogenic theory. He maintained that faults in the process of hair and gland development give rise to cysts, and that the forerunner of the pilonidal sinus in man may be a specialized and transient skin appendage, the function and homologues of which in other species are as yet undetermined.

Stone[10,11] believed that the sinus is the result of a special downgrowth of epithelium from true skin, and not from the medullary groove; he compared this structure with other organs formed by special downgrowths, such as the breast and the external ear. He later allied this sinus to the preen gland (glandula uropygii) of many species of birds, a multitubular gland embedded in the subcutaneous fat over the lowermost caudal vertebrae, whose tubules converge and empty through an epithelial-lined duct to the skin of the back.

Newell[12] believed that the pilonidal sinus is a dermoid fistula, but differing from a true sequestration dermoid in that it is caused by traction of the underlying tissues upon the median raphe. This traction is probably caused by the retrogression of the tail bud and the structure could therefore be described as a traction dermoid. He postulated that an epithelial-lined fistula is present at birth, and may remain for a time without giving rise to symptoms. With the growth of the body and enlargement of the buttocks, the secretion of this epithelium is unable to escape by the orifices in the mid-line, and retention of secretion may result in sepsis followed by an abscess.

Haworth and Zachary[13] discuss 11 cases of pilonidal sinuses in infants presenting with symptoms, 3 of which communicated with the spinal canal. In an additional 7 cases pilonidal sinuses were found as an associated condition amongst 500 infants attending an out-patient department. They are of the opinion that all pilonidal sinuses are congenital, and that only in adult life do they produce symptoms because of obstruction to the opening of the sinus by hairs.

Objections

The congenital theory fails to explain the following difficulties:

1. That hairs in the sinus lie free.
2. That no one has yet confirmed the presence of skin appendages in the lining deep to the opening on histological section of the sinus in the adult.
3. The rarity of the condition in Africans, in whom, when it does occur, is seen more commonly in females.
4. The rare occurrence of sinuses or cysts in children.

THEORIES OF ACQUIRED ORIGIN

Warren[15] in 1854 and Hodges[16] in 1894 held that pilonidal sinuses may be produced by constant pressure, explaining that body hairs broken off by friction in a pilous region may become matted together and lodge in a depression, and in the course of time excoriate the surface softened by continuous perspiration and penetrate the integument, finally provoking inflammation and suppuration. Brearley[17] and Patey and Scarf[18,19] also suggested that these sinuses were acquired.

Brearley,[17] drawing from his own cases and those of Patey and Scarf, suggested the following cause: In most of the sites where a pilonidal sinus occurs there are nearly always two opposing flat surfaces producing a rolling movement. This twists the hair into a bundle and drills it obliquely through the skin. Once this has happened, suction plays a part. In the buttocks this is produced by the fact that the skin is attached to the deep fascia, and any force which draws the skin laterally across the buttocks puts tension on this fascial attachment and thereby creates a suction force. Brearley was able to measure pressure by inserting a needle into the subcutaneous tissue of the gluteal cleft and connecting it to a manometer filled with saline.

Brearley explains the age incidence of pilonidal sinus by the fact that only after puberty do stiff body hairs appear, and after middle age the hairs soften and those who are likely to have suffered from the condition would have already acquired it. The preponderance in men (see below) is explained by the existence of more stiff body hairs in males.

He ascribes the rarity of the condition in Negroes to the fact that they have less body hair and that what they have is curly and ill-adapted to having a drilling effect.

Patey and Scarf[20] give a reasoned explanation for the presence of hairs in the sinus with their roots lying deeply. The scales of a hair are so arranged that their free ends point peripherally. As a result, if a hair is stroked along its surface from the root to the periphery there is little movement of the hair, because of its slight frictional resistance. If, however, a hair is stroked from the periphery to the root there is considerable frictional resistance from the free ends of the hair scales and the hair is propelled in the direction of its roots. This can readily be confirmed by placing a hair in the palm of the hand and rubbing to and fro with a finger of the other hand.

In the natal cleft, therefore, shed hairs will tend to lie longitudinally owing to the configuration of the cleft. The normal frictional movement between the sides of the cleft will propel the hair either cranially or caudally, according to the direction in which the roots of the hair happen to be pointing. If a dimple or pit is present many of the cranially propelled hairs will enter its orifice, invariably root first. The same forces will resist the expulsion of the hairs and tend to force their roots still further into the depths of the sinus. They also drive an infected hair into the intact skin and thus initiate a pilonidal sinus.

PATHOLOGY, AETIOLOGY AND CLINICAL FINDINGS

The majority of cases in the present series were infected, and in only one case could the findings of serial sections of an infected track be seen.

There is always a primary track; it most commonly has an opening in the mid-line but occasionally this may be to either side. In this series, however, the majority opened to the left side rather than in the mid-line. There may be multiple primary openings but they all open into the main track in the mid-line. The track runs upwards and anteriorly.

Hairs may be seen lying free and protruding through the sinus opening but, as most of the cases in this series were infected or had been treated before, free hairs were seen in only one case.

Histologically, sections of the one non-infected case confirmed Aird's statement[7] that the first few millimetres were characteristic of the skin, with epithelial lining, but beyond this the lining was of granulation tissue. No hair follicles, sweat glands or sebaceous glands were seen in the sections.

Both Brearley[17] and Patey and Scarf[18,19] failed to find evidence of skin appendages in the sinus track of the cases they sectioned.

Pilonidal sinus is found predominantly in young, dark, hairy, adult males. Males are affected more than females in the ratio of 7 to 1. It is rare among Negroes, but by no means uncommon among Indians. A total of 77,600 soldiers were admitted to U.S. Army Hospitals for pilonidal disease from 1942 to 1945.[21]

Occupation may play a part and Buie[22,23] thought it such a common factor that he named it 'jeep disease', supposing that the trauma from the continual jolting acted as a sort of percussing force and assisted penetration of hairs in susceptible subjects.

It is very rare to have a patient present without symptoms, but the condition may be a coincidental finding. In nearly every case, the predominant symptom is recurrent abscess and associated pain in the coccygeal area. Occasionally it may be very difficult to find a sinus opening but with patient probing the sinus opening can always be established. Fine hairs may be seen protruding from the sinus opening, particularly in cases seen for the first time. One patient in this series, a young university student (White male) showed this very clearly (Fig. 1).

Systemic symptoms are very rare and, unless a very extensive cellulitis has resulted from the abscesses, pyrexia, nausea and vomiting are, indeed, a rarity.

Fig. 1. Tuft of hair shown protruding through sinus opening. Note also marked hirsutism.

Diagnosis and Differential Diagnosis

A history of recurring pain and discomfort in the sacrococcygeal region, frequently with a discharge, is very suggestive.

In the acute stage an ischiorectal abscess may be mistaken for a pilonidal, but the former usually presents a definite systemic reaction. The origin of an ischiorectal abscess is almost always within the anorectal canal, and the abscess itself is merely a stage in the development of an anorectal fistula. From its position and tenderness in the anal or rectal canal, and the discovery of an internal opening at or near the anorectal line, the diagnosis is clear.

A fistula-in-ano is shown by probing, proctoscopy and sigmoidoscopy. It should be noted that the mid-line pilonidal sinus always goes deep and cranially. Boils, carbuncles, infected sebaceous cysts, seldom give the characteristic prolonged history, nor that of repeated attacks. Other conditions to keep in mind are osteomyelitis and tuberculosis of the sacrum, which can be ruled out by X-ray examination. Actinomycosis may occur in this area and is to be excluded by bacteriological examination.

Inclusion dermoids, chordomas, teratomas and other neoplasms have to be considered. In the great majority of cases of pilonidal sinus careful search will reveal one or more characteristic mid-line openings, and if hair, as in the occasional case, is seen protruding from the sinus it will make the diagnosis obvious.

TREATMENT

Various methods of treatment have been proposed, which is testimony to the fact that no one procedure is outstandingly successful in avoiding morbidity and recurrences. No single technique can be laid down but the treatment must be suited to the local condition.

Swinton[24] raises a very important point when he states that a common pitfall is to regard the treatment of a pilonidal sinus as a minor surgical procedure; it is far from being an insignificant surgical problem. How true is the following note of warning:[25] 'All methods of dealing with pilonidal sinus have in common the grim determination of their originator to make them more effective, and by dint of exceptional care with the operation, or—in open operations—with the dressings, better results are obtained. It is extraordinary that so simple a lesion should tax the surgeons' ingenuity, but it is about time to admit the fact that what it taxes is not the adequacy of the method employed, but how well, how carefully, and how gently the surgeon executes it'.

In the treatment sufficient attention is often not given to basic surgical principles. Proper sterilization of the skin and depilation of the area before the operation, elimination of all dead space and complete haemostasis, prevention of infection and avoidance of tension, and finally rest in bed until the skin wound is healed, are all essential.

Proper planning must be the primary consideration. If more than one sinus exists, all are to be probed to see their connection with the main sinus.

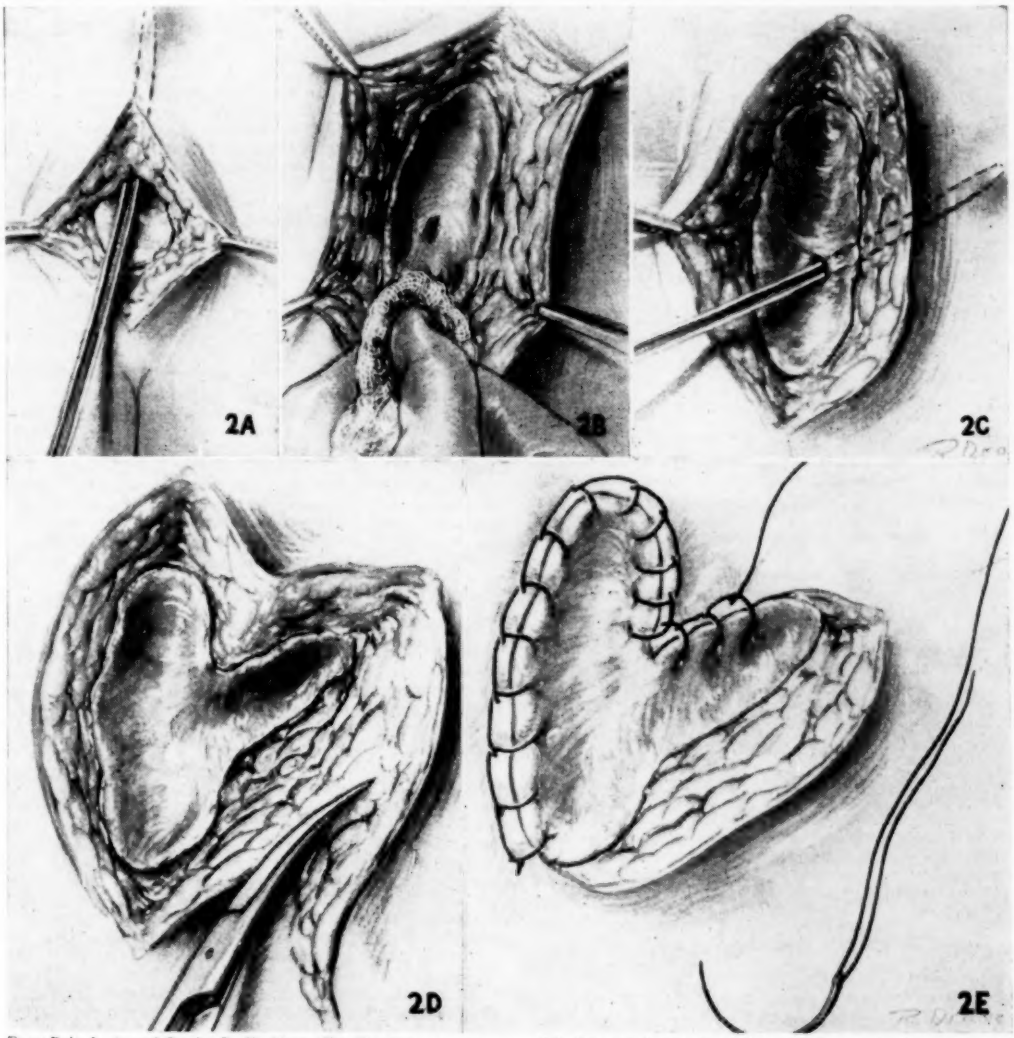

Fig. 2. From Buie, L. A. and Curtiss R. K. (*Surg. Clin. N. Amer.*, August 1952, p. 1247). Artist, Drake, R.
2A. The pilonidal sinus has been incised partially. A grooved director is in place.
2B. The wall of the abscess has been scrubbed and a subsidiary tract is revealed.
2C. Grooved director inserted in subsidiary tract.
2D. The wound is being trimmed so that the margins of the skin can be made to fit the edges of the scar.
2E. The application of a continuous lock stitch marsupializes the wound.

Should there be multiple sinuses that can be incorporated in a transverse incision, there can be no objection to such an attack if it avoids massive excision of healthy tissues.[26]

Pulaski[27] studied 157 cases and concluded that antibiotics play a minor role and that a permanent cure is dependent on careful attention to fundamental surgical principles.

Before the surgical problem of the chronic or recurrent pilonidal sinus is considered, reference should be made to the case presenting with an acute abscess. This presents no problem. It should always be drained, and the incision should be so designed as not to interfere with the definitive treatment at a later date. A block excision of the inflamed mass is contra-indicated.

THE CHRONICALLY INFECTED PILONIDAL SINUS

The definitive treatment in these cases can be discussed under the following headings: (1) conservative, (2) the open method, (3) the closed method.

1. *Conservative Method*

This was developed by Hardaway,[21] of the U.S. Army, because of his dissatisfaction with the results of operative treatment. The entire intergluteal area is shaved every 4 to 5 days; all hair is removed from the sinus opening and kept out. Sedulous personal hygiene is observed, with thorough daily soap-and-water cleansings of the intergluteal area. Hexachlorophene detergent should be used if possible. After defaecation the anal area is cleansed with the movement away from the intergluteal region. The area is kept as dry as possible. The patient is advised not to drive a vehicle.

Other non-operative methods have been employed, such as sclerotherapy[28] and electrotherapy, but have not proved very successful.

2. *The Open Method*

This can be performed either by liberal excision or with the cautery.

Excision by hot cautery has been performed by Rogers.[29] An incision is made in the mid-line through the cyst down to the fascia covering the sacrum and coccyx. The cyst is excised in two parts and the wound packed with petroleum gauze. The dressing is changed every second day and replaced by iodoform gauze, eusol, or saline dressings, according to the amount of discharge present.

The objection to the open method is the long delay in healing, with resultant long hospitalization; and follow-up on patients so treated showed that at least 10 - 15% required further surgery because of a discharging mid-line sinus. It should not be overlooked that these patients suffer a great deal of post-operative discomfort and great pain; they are also a very trying nursing problem, requiring constant attention and repeated change of dressings. The average healing time is 8 - 14 weeks.

To overcome this, a method of marsupialization has been evolved, first described by Buie.[22] Lawrence and Baker[30] give details of 120 cases treated in this way. The sinus, including any lateral extensions, is laid open and chronically infected granulation tissue and hair nests are curetted out. The skin edges are then sutured to the lateral margins of the scar-tissue bed of the sinus in such a way that the wound is converted into a saucer with the fibrous wall of the cavity exposed only at the bottom. The wound is usually a quarter of the size of the wound produced by excision and therefore healing time is more than halved (Fig. 2, A - E).

3. *Excision with Primary Closure*

The method now to be described was used in 20 cases in the present series, both White and non-White. All these patients underwent excision of their sinuses with primary closure, and they were all healed in 14 days. In a follow-up of from 3 to 18 months none have shown evidence of recurrence.

Pre-operatively the skin is prepared as for an orthopaedic operation. Pubic, perineal, sacral and anal hairs are shaved over a wide expanse. In 2 cases pre-operative depilation doses of X-rays were given. If any discharge is present, swabs are taken for culture and sensitivity tests carried out; and a suitable antibiotic is commenced on the day before operation and continued for 7 - 10 days afterwards. The patient is placed on a low-residue diet 2 days before operation and this is continued for 12 days after the operation.

General anaesthesia was used in every case. The patient was placed prone, with a pillow under the pelvis and in a slight head-down and leg-down position so as to make the sacrococcygeal area more prominent. Elastoplast was then fixed to each buttock and traction applied to open up the gluteal cleft. The strapping should be well beyond the field of operation so that later contamination may not occur. The operative field is now thoroughly prepared for operation. Care is taken to exclude the anal region from the operative site.

An elliptical incision is made, starting in the mid-line approximately 1½ - 2 inches above the sinus opening and usually including 1 - 1½ cm. of healthy skin on either side of the main sinus. The two limbs of the ellipse meet again in the mid-line, approximately 1½ - 2 inches below the sinus opening. Lateral extensions to take in secondary sinuses are in the form of wedge extensions off the main incision. The proximal part of the ellipse is first freed and grasped in a Lane's tissue forceps, and the incision is deepened on either side through fat, down to the glistening sacral fascia, in the meantime lateral traction being maintained on the edges of the wound. As the incision on either side deepens and extends caudally, more Lane's tissue forceps are applied to the freed tissue and, by manœuvring the elevated tissue from side to side, freeing of the block of tissue is facilitated. At the lower pole, care is taken not to approach too near the anal region. As the distal part is freed and deepened, another Lane forceps grasps this end and, with firm traction on all the forceps, it is a very simple procedure to free the whole block of tissue. After excision, a hot saline pack is introduced into the cavity and firm pressure applied for 5 - 10 minutes. Where necessary the cautery has been preferred for bleeding points.

The glistening fascia below reveals that the sinus has been adequately removed. Search is made for further sinuses and any small pocketing in the depths of the wound is adequately dealt with.

With a large curved cutting needle threaded with long medium-strength nylon, the first suture is inserted at the top end of the wound, approximately 1½ inches from the edge of the wound. The stitch is so inserted as to penetrate through gluteal fascia on the same side down to the sacral fascia and across to the gluteal fascia on the opposite side. The stitch is then made to return so as to produce a figure-of-eight and emerges on the same side at a distance of about 1 inch above its original insertion (Fig. 3A).

The ends are left long and separated, with artery forceps on each end. A similar stitch on the opposite side is introduced, which interlocks with the stitch first inserted (Fig. 3A). Three such pairs of stitches on each side are usually inserted. Penicillin and streptomycin powder is then dusted into the wound after haemostasis has been assured. The elastoplast strapping is then cut so as to let the buttocks appose and evaginating interrupted mattress sutures of black silk are carefully inserted and tied so as to accurately approximate the skin edges (Fig. 3B).

A large snugly-fitting gauze roll (specially prepared by rolling gauze swabs together in the form of a sausage) is then laid down the length of the sutured wound (Fig. 3B), and a similar sized gauze roll is laid across this one at right angles to it, starting at the proximal end first. This gauze roll is kept in position by tying the nylon strands firmly over the roll at its two lateral ends, care being taken that each corresponding pair of nylon sutures are tied. This has the effect of reducing the dead-space by drawing the gluteal fascia together. Two similar rolls are laid across parallel to the transverse-lying roll and similarly tied (Fig. 3C).

The patient is returned to the ward and placed flat in bed in a supine position with one head pillow. On regaining consciousness he is instructed to remain in this position and, although the wound area is tender, there is slight discomfort for the first 48 hours, and only one or two post-operative injections of pethidine are required in most cases. It is felt that by lying in this position further obliteration of the dead-space by pressure is obtained.

Tinct opii (10 minims) is given to keep the bowels costive, and low-residue diet without milk is continued. The antibiotic given

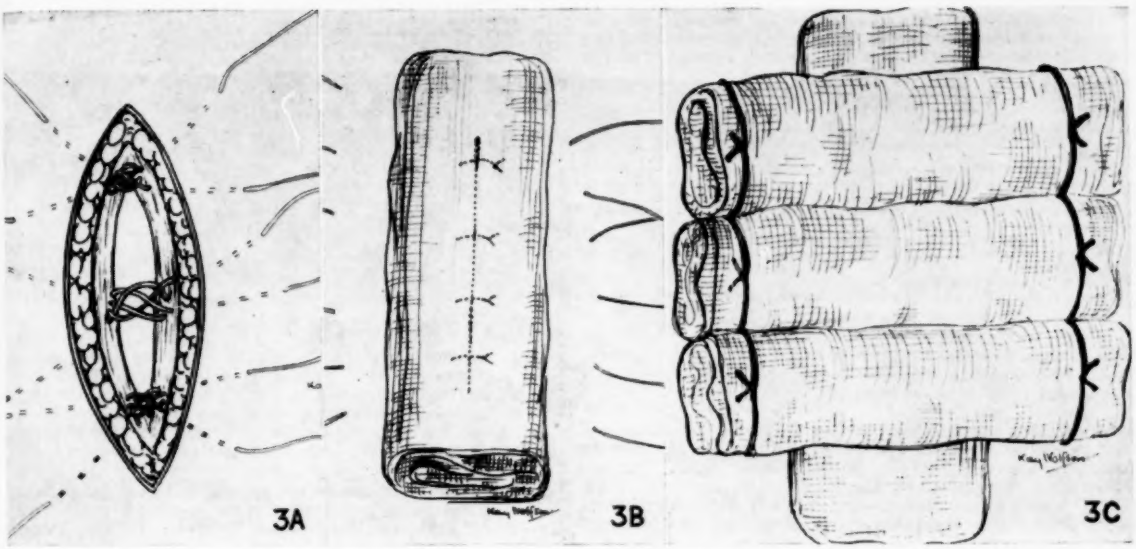

Fig. 3. Method of suture of wound after excision of sinus.
A. Shows figure-of-eight sutures (thick nylon) passing through skin and gluteal fascia on same side, picking up gluteal fascia on the opposite side, and returning to same side as entering suture.
B. After figure-of-eight sutures inserted, skin apposed with silk sutures and first longitudinal roll of gauze applied.
C. Horizontal gauze rolls now applied and figure-of-eight sutures tied over end of each horizontal roll.

before the day of operation is continued for 10 days. The patient is not allowed up, and remains recumbent for 10 days.

Although some of the patients complained of abdominal discomfort because of constipation, in no case did it require any alleviation or treatment. A close watch is kept on the temperature chart and the dressings are examined each day by rolling the patient over. In no case was it necessary to remove the dressings until the 14th day. Every case healed by primary intention, and in only one case was a mild degree of sepsis present in the lateral stitch wounds, which quickly responded to saline dressings.

Attention to fundamental surgical principles has given good results. To this must be added the fact that the chance of soiling from faecal contamination is eliminated as far as possible and plays a very important part in the prevention of infection.

SUMMARY

1. The various theories of the formation of a pilonidal sinus are presented. A combination of both acquired and congenital factors appear to play a greater or lesser part in any one case.

2. The histopathology is considered, which tends to support the role of an acquired factor.

3. The diagnosis and differential diagnosis is discussed.

4. The various methods of treatment are described and, finally, a particular operative method is presented in detail.

I should like to express my thanks to Dr. S. Disler, Medical Superintendent, King Edward VIII Hospital, and to Mr. I. Goldberg, under whose care some of these cases were, and who allowed me to operate on them.

I am indebted to Mr. D. Lang-Stevenson, of Whipps Cross Hospital, London, without whose guidance I could not have learned the finer details of this technique.

Finally, I am grateful to the artist, Mrs. K. Wolfson, of the Social Preventive and Family Medicine Department of the University of Natal, and to Mr. C. R. Stewart, of the Photographic Unit, Department of Pathology, University of Natal.

ADDENDUM

Since the time of writing a coincidental finding of a sinus over the sacrococcygeal area was made in a male child 6 weeks old, who was admitted to a childrens' medical ward for gastro-enteritis. Fig. 4 shows the sinus clearly in the characteristic position. The mother said that no secretion or discharge had ever emanated from the sinus opening. The child was otherwise perfectly normal. Both lower limbs were carefully examined to rule out any lesion of the central nervous system, and X-rays revealed no evidence of spina bifida or agenesis of the sacrum. Probing under strict aseptic conditions showed that the sinus extended upwards for a distance of 1·5 cm. and ended at the spinal column.

No specific treatment has been instituted at the moment but it is hoped to follow the case as an out-patient and to excise the sinus at a later date.

Fig. 4. See text.

The lesion is certainly what Haworth and Zachary[13] describe as a congenital sacrococcygeal dermal sinus, and supports their contention that pilonidal sinuses at this site—discovered later in adults —may be developmental in origin.

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PASSING EVENTS : IN DIE VERBYGAAN

N.B. Groote Schuur Hospital, Cape Town. Will members please note that the telephone number of this hospital will be changed to **55-1111** as from 30 - 31 July.

* * *

South African Institute for Medical Research, Johannesburg, Staff Scientific Meeting. The next meeting will be held on Monday 8 August at 5.10 p.m. in the Institute Lecture Theatre. Dr. Regina Schoental, of the Toxicology Research Unit, M.R.C. Laboratories, Surrey, England, will speak on 'Experimental liver lesions caused by pyrrolizidine alkaloids and their bearing on human liver diseases'.

* * *

University of Cape Town and Association of Surgeons of South Africa (M.A.S.A.), Joint Lectures. The next lecture in this series will be held on Wednesday 3 August at 5.30 p.m. in the E-floor Lecture Theatre, Groote Schuur Hospital, Observatory, Cape. Drs. S. Cywes, G. Efron and L. C. J. van Rensburg will report on the current research being carried out in the experimental-surgery laboratory of the University of Cape Town. All members of the Medical Association are welcome to attend this lecture.

* * *

Dr. Pericles Menof, of Johannesburg, will leave for the Continent on 3 August. While in Europe Dr. Menof will attend the 6th International Congress of Internal Medicine in Basel on 24 - 27 August where he will read a paper on the thyroid treatment of essential hypertension. He will be away for 3 months.

Dr. Pericles Menof, van Johannesburg, sal op 3 Augustus na die Kontinent vertrek. Gedurende sy verblyf in Europa sal hy die 6e Internasionale Kongres vir Interne Geneeskunde te Basel op 24 - 27 Augustus bywoon en ook 'n voordrag lewer oor die behandeling van essensiële hipertensie met gedroogde skildklier. Hy sal 3 maande lank weg wees.

* * *

Dr. Lorn Shore, paediatrician, of Cape Town, has recently returned from a trip overseas where he visited allergy units in Paris, London and Copenhagen. Dr. Shore has now resumed practice.

* * *

Dr. P. J. Mitford Retief, Ch.M., of Cape Town, has recently returned to South Africa after visiting urological centres in the UK and attending a meeting of the British Association of Urological Surgeons.

* * *

Dr. Louis Schrire, of Cape Town, has recently returned from a trip overseas where he visited ophthalmological clinics in Europe and England, and has resumed practice at 517 Medical Centre, Heerengracht, Cape Town.

* * *

Dr. and Mrs. A. G. Paterson have recently returned to Cape Town after a three months' overseas visit to the UK. While in England Dr. Paterson attended a meeting of the British College of General Practitioners. Dr. Paterson is a member of the Federal Council of the Medical Association.

THE MEDICAL ASSOCIATION OF SOUTH AFRICA

BALANCE SHEET 31 DECEMBER 1959

1958 £		£ s. d.	£ s. d.
	Accumulated Funds		
22,153	Balance, 31 December 1958	13,347 18 6	
Loss (8,805)	Add: Excess of Income over Expenditure for the year	922 8 10	
13,348			14,270 7 4
	Dr. J. S. du Toit Memorial Fund Capital Account		
175	Contributions Received and Interest		225 10 3
—	*Visiting Lecturers' Fund*		480 7 6
	Liabilities		
15,823	Sundry Creditors		18,267 7 7
1,322	Bank Overdraft		
£30,668			£33,243 12 8

1958 £		£ s. d.	£ s. d.
	Fixed Assets		
7,279	Landed Property—'Byrness', Newlands Avenue, Newlands, Cape —at cost		7,278 18 9
3,861	Office Furniture, Fixtures and Machines		3,872 9 1
3,080	Net Book Value 1 January 1953	2,991 19 0	
3,114	Purchased since that date at cost	3,584 11 2	
6,194		6,576 10 2	
2,333	Depreciation since 1 January 1953	2,704 1 1	
	Investments		
11,170	Sundry Investments—at cost		11,170 0 0
1,350	Quoted Union Government Stock (Market Value, 31 December 1959 £1,122 — 1958 £1,097)	1,350 0 0	
9,820	Unquoted Shares	9,820 0 0	
	Current Assets		
8,140	Sundry Debtors less Provision for Doubtful Debts		8,273 13 2
43	Cash on Hand and at Bank		2,423 1 5
	Dr. J. S. du Toit Memorial Fund		
175	Cash on Savings Account		225 10 3
£30,668			£33,243 12 8

GENERAL INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 DECEMBER 1959

1958 £		£ s. d.	£ s. d.
2,815	*Deficits Transferred*		1,883 2 4
2,376	Journal Account	1,499 0 1	
356	Laboratory and Clinical Medicine Account	384 2 3	
83	Agency Account: Cape Town	—	
16,745	*Administration Expenses*		18,337 3 4
12,636	Salaries	13,913 1 3	
1,685	Rent	1,818 9 0	
528	Printing, Stationery and Office Requisites	684 0 8	
459	Subscriptions	451 15 6	
355	Pension Fund Contributions	383 13 8	
233	Telephones	302 8 3	
342	Sundry Office Expenses	238 7 3	
204	Postages and Telegrams	248 11 1	
177	Depreciation — Office Furniture, Fixtures and Machines	176 17 8	
63	Audit Fees	62 10 0	
53	Bank Charges	52 13 9	
10	Unemployment Insurance Fund Contributions	4 15 3	
5,072	*Sundry Expenses*		6,347 11 10
3,206	Travelling Expenses Delegates 4,367 9 5	5,391 15 9	
1,090	Secretary Associate Secretary and Staff 1,024 6 4		
315	Expenses — *History of Medicine in South Africa*	—	
100	Entertainment Allowances	375 0 0	
—	Chairman of Council 100 0 0		
125	President 100 0 0		
	Secretaries 175 0 0		
170	Amendments to Articles of Association	—	
57	Various Expenses re Federal Council	340 12 10	
—	Cost of Booklets	237 6 6	
3	Insurance	2 16 9	
6	Legal Expenses	—	
240	*Staff Pensions*		—
800	*Grants to Universities for Library Services*		800 0 0
692	*Expenses — 'Byrness'*		119 16 11
169	*Bad Debts Written Off*		—
10	*Loss on Sale of Office Equipment*		72 18 0
Loss (8,805)	*Excess of Income over Expenditure* transferred to *Accumulated Funds*		922 8 10
£17,738			£28,483 1 3

1958 £		£ s. d.	£ s. d.
	Surplus Transferred		849 13 2
208	Agency Accounts—Johannesburg	124 12 3	
—	Cape Town	725 0 11	
11,443	*Members' Subscriptions*		22,924 16 5
4,030	*Insurance Commission*		3,848 6 11
400	*Interest on Investments*		330 7 0
250	*Rent — 'Byrness'*		250 0 0
1,164	*Members' Donations in Response to Treasurer's Appeal*		114 9 3
33	*Sales of Booklets*		113 9 11
—	*Refund on Cancelled Pension Fund Policy*		28 15 7
30	*Hire of Office Machines*		15 0 0
5	*Miscellaneous Revenue*		8 3 0
175	*Decrease in Provision for Doubtful Debts*		—
—	*42nd South African Medical Congress*		—
	Surplus Realized on Congress held at Durban in September 1957	480 7 6	
	Less: Amount transferred to Visiting Lecturers' Fund	480 7 6	
£17,738			£28,483 1 3

THE MEDICAL ASSOCIATION OF SOUTH AFRICA BENEVOLENT FUND
BALANCE SHEET 31 DECEMBER 1959

1958 £		£ s. d.	£ s. d.
	Accumulated Funds		
47,546	*Balance, 31 December 1959*		51,981 2 9
£47,546			£51,981 2 9

1958 £		£ s. d.	£ s. d.
	Assets		
	Investments at Cost:		
	Union Government Stocks (Quoted) (Market Value 31 December 1959 £5,096 — 1958 £5,017)		
5,575	£2,500 3½% 1962/65	2,450 0 0	
	£1,125 3% 1957/64	1,125 0 0	
	£1,000 3% 1959/69	1,000 0 0	
	£1,000 3% 1960/70	1,000 0 0	5,575 0 0
9,676	*Building Society Shares (Unquoted)* Saambou (Permanente) Bouvereniging — 13,579 Fully Paid-up Indefinite Shares of £1 each		13,579 0 0
29,239	*Secured Loan* Medical House (Proprietary) Limited — First Mortgage on Medical House, Wale Street, Cape Town		29,239 0 0
			48,393 0 0
1,133	*Sundry Debtors*		714 8 0
	Interest Accrued	706 18 0	
	Sundries	7 10 0	
1,923	*Cash on Hand and at Bank*		2,873 14 9
£47,546			£51,981 2 9

INCOME AND EXPENDITURE ACCOUNT FOR THE YEAR ENDED 31 DECEMBER 1959

1958		£ s. d.	1958		£ s. d.
£			£		
3,746	*Benevolent Payments*	4,592 17 3	2,446	*Interest on Investments*	2,680 2 4
20	*Stationery and General Expenses*	3 9 9		*Appropriation from Capital for*	
			1,320	*Additional Benevolence*	1,916 4 8
£3,766		£4,596 7 0	£3,766		£4,596 7 0

ACCUMULATED FUNDS

	Appropriation to Income and Expenditure Account for Additional		44,352	*Balance, 31 December 1958*		47,546 12 8
1,320	*Benevolence*	1,916 4 8		*Contributions to Capital for the*		
47,546	*Balance, 31 December 1959*	51,981 2 9	4,514	*Year Ended 31 December 1959*		6,350 14 9
			3,362	Donations	5,578 10 3	
			476	Services Rendered	590 16 0	
			676	Votive Cards	181 8 6	
£48,866		£53,897 7 5	£48,866			£53,897 7 5

REPORT OF THE AUDITORS TO THE MEMBERS OF THE MEDICAL ASSOCIATION OF SOUTH AFRICA

We have examined the books and accounts and vouchers of the Association and have satisfied ourselves of the existence of the securities. We have obtained all the information and explanations which, to the best of our knowledge and belief, were necessary for the purpose of our audit. In our opinion, proper books of account have been kept by the Association, so far as appears from our examination of those books.

The above Balance Sheet and attached Income and Expenditure Account are in agreement with the books of account. In our opinion, and to the best of our information and according to the explanations given to us, the said Accounts give the information required by the Companies Act 1926, as amended, in the manner so required and the Balance Sheet gives a true and fair view of the state of the Association's affairs as at 31 December 1959, and the Income and Expenditure Account gives a true and fair view of the surplus for the year ended on that date.

Cape Town
13 April 1960

Gurney, Notcutt & Fisher
Chartered Accountants (S.A.)
Auditors

BENEVOLENT FUND

We have examined the books and accounts and vouchers of the Benevolent Fund and satisfied ourselves of the existence of the securities. The above Balance Sheet and attached Statements of Income and Expenditure and Accumulated Funds are in agreement with the books of account. In our opinion the Balance Sheet gives a true and fair view of the state of the Fund's affairs as at 31 December 1959, and the Statements of Income and Expenditure and Accumulated Funds give a true and fair view of the Income and Expenditure of the Fund in respect of the year ended on that date.

Cape Town
16 March 1960

Gurney, Notcutt & Fisher
Chartered Accountants (S.A.)
Auditors

WORLD LIST OF FUTURE INTERNATIONAL MEETINGS

Following is a list of international medical meetings to be held during the period January - June 1961. Alterations and additions to this list will continue to be published in the *Journal* from time to time together with information concerning meetings taking place before January 1961. For the full list of meetings taking place between July - December 1960 see the issue of the *Journal* for 26 March 1960 (**34**, 266).

Inter-African Conference on Malariology, Yaounde, Cameroons ?, January 1961. World Health Organization, Palais des Nations, Geneva, Switzerland.

International Anaesthesia Research Society, 35th Congress, Houston, USA, March or April 1961. Dr. A. William Friend, Executive Secretary, E. 107 and Park Lane, Cleveland 6, Ohio.

Aerospace Medical Association, 32nd Annual Meeting, Chicago, 24 - 26 April 1961. Dr. William J. Kennard, Secretary-Treasurer, c/o Washington National Airport, Washington D.C., USA.

International Association for Bronchology, 11th Congress, Rome, May ?, 1961. Dr. J. M. Lemoine, Secretary General of the Association, 189 boul. St.-Germain, Paris 7e, France.

Fifth International Congress of Legal Medicine and of Social Medicine, Vienna, May 1961. Prof. William Holczabeck, Secretary General, Sensegasse 2, Vienna, Austria.

Fourth International Medical-Surgical Film Festival, Turin, 3 - 11 June 1961. Minerva Medica, Corso Bramante 83 - 85, Turin, Italy. A large number of international and national medical and surgical meetings will be held on the occasion of the Festival.

Fourth International Medico-Surgical Meetings, Turin, 3 - 11 June 1961. Minerva Medica, Corso Bramante 83 - 85, Casella postale 491, Turin, Italy.

Third World Congress of Psychiatry, Montreal, 4 - 10 June 1961. Alison Groom, Executive Secretary of the Congress, McGill University, 1025 Pine Av. West, Montreal 2, Canada.

American Medical Association, Annual Meeting, New York, 26 - 30 June 1961. Dr. F. J. L. Blasingame, Executive Vice-President, 535 N. Dearborn St., Chicago 10, Illinois, USA.

Association of Physicians of East Africa, Annual Conference, June 1961. J. Michael Vaizey, M.D. (Cantab.), Hon. Secretary of the Association, P.O. Box 43, Kampala, Uganda.

European Union of Social Medicine, General Meeting, Turin, June 1961. Minerva Medica, Corso Bramante 83 - 85, Turin, Italy.

Fifth Inter-American Conference on Rehabilitation, São Paulo and Rio de Janeiro, June 1961. International Society for the Welfare of Cripples, 701 First Av., New York 17, N.Y., USA.

International Union of the Medical Press, 5th Congress, Turin, June 1961. Prof. Oliario, Minerva Medica, Corso Bramante 83 - 85, Turin, Italy.

Second World Congress of Latin Dermatologists, Turin, June 1961. Minerva Medica, Corso Bramante 83 - 85, Turin, Italy.

World Meeting on Experimental Surgery, Turin, June 1961. Minerva Medica, Corso Bramante 83 - 85, Turin, Italy.

World Meeting on Physiatrics, Turin, June 1961. Minerva Medica, Corso Bramante 83 - 85, Turin, Italy.

World Symposium on Genetics, Turin, June 1961. Minerva Medica, Corso Bramante 83 - 85, Turin, Italy.

World Symposium on Obstetrics and Gynaecology, Turin, June 1961. Minerva Medica, Corso Bramante 83 - 85, Turin, Italy.

World Symposium on the Physiopathology of Renal Papilla, Turin, June 1961. Minerva Medica, Corso Bramante 83 - 85, Turin, Italy.

WORLD MEDICAL ASSOCIATION

AFRICAN GOOD-WILL TRIP

A group of Canadians under the auspices of the Canadian Supporting Committee of the World Medical Association are undertaking an extensive tour of Africa. Among their numerous purposes are: To talk to medical men discussing common problems and interests and trying to understand their problems and help them see those of the Canadian doctors; and to create and cultivate good-will and understanding with newly formed countries such as Ghana, Nigeria, Congo, and others.

The personnel of the team includes: Drs. G. Alan Lane, general surgeon; Jack Sibley, internal medicine; William Lockington, general practice; William Love, ear, nose and throat; Fred Doerffer, obstetrician and gynaecologist; J. W. McNichol, plastic surgeon; Morley Weaver, eye surgeon; J. G. Holbrook, dentist; Lincoln Alexander, lawyer; Miss Glen Dawson, music supervisor, public schools; Mrs. Carl Zurbrigg, minister, Olivet United Church, and Mrs. G. W. Birtch, minister's wife.

The wives of the doctors will accompany the team members at the specific invitation of Dr. James H. Robinson, Director of the Crossroads Africa group. Part of the group hopes to visit Dr. Albert Schweitzer at Lambarene.

NEW PREPARATIONS AND APPLIANCES : NUWE PREPARATE EN TOESTELLE

POTCRATE

Vernleigh Products (Pty.) Ltd. introduce Potcrate, a new antithyroid drug, and supply the following information:

Potcrate tablets contain 3 gr. purest potassium perchlorate, $KC10_4$. Long-term tests have shown potassium perchlorate to be the ideal antithyroid drug, well tolerated by all patients even after continuous therapy over a period of months.

Potcrate tablets are indicated for all types of hyperthyroidism and thyrotoxicosis. The mean time to cure Graves' disease using 5 tablets of Potcrate daily, has been shown to be 9·4 weeks. After a few days the general condition of the patient improves, palpitation of the heart disappears, nervous symptoms are alleviated and previous diarrhoea is removed. Most patients gain weight.

A few patients have reported nausea and occasionally a maculopapular rash. These reactions disappeared after a few days. Hypothyroidism must of course be avoided.

Dosage. The recommended adult dose is 4 or 5 tablets of Potcrate taken over the course of a day. It may be necessary to halve the dose after 2 - 4 weeks. Combined iodine and Potcrate treatments are not recommended. Cough remedies which contain iodine should be avoided.

Potcrate is issued in bottles of 100 and 500 tablets.

Further information may be obtained from Vernleigh Products (Pty.) Ltd., P.O. Box 9027, Johannesburg.

STAPHYLOMYCIN

Keatings Pharmaceuticals Ltd. announce the introduction of Staphylomycin, a new antibiotic discovered and perfected by the R.I.T. Laboratories, of Belgium, and supply the following information:

Staphylomycin is bactericidal in low concentrations and destroys even those strains of staphylococci resistant to antibiotics such as erythromycin, novobiocin, chloramphenicol and chlortetracyclin.

A striking feature of Staphylomycin is the complete absence of toxicity. Clinically, no untoward renal or hepatic effects have been reported, nor has Staphylomycin therapy affected the nervous or haematopoietic systems — notwithstanding the fact that extremely high doses have been administered.

The only side-effects reported are gastric intolerance (in less than 2% of patients) and, even less frequently, skin reactions, either cutaneous or mucous.

Although Staphylomycin is effective in infections caused by staphylococci, streptococci and pneumococci, its major role lies in the treatment of infections caused by strains of staphylococci resistant to other antibiotics.

Staphylomycin is available in capsules, throat tablets, eye drops, ointment, surgical powder, and a suspension for instillation.

Staphylococcal enterocolitis, staphylococcal septicaemia, staphylococcal pneumonia and staphylococcal pulmonary abscesses have been successfully treated with the capsules.

The daily dose is 12 capsules until improvement commences (usually on the second day), thereafter 6 capsules daily. The reduced dosage should be administered for 2 - 3 days after the temperature has returned to normal.

The initial dose for children is 30 mg. per kg. body weight daily with a daily maintenance dose of 20 mg. per kg. body weight.

Chronic osteomyelitis (when a fistula is present) and breast abscesses will respond to the instillation of the suspension.

In urology staphylococcal pyelitis and cystitis both respond rapidly to the oral administration of Staphylomycin; it is eliminated through the kidneys and is recovered in a concentrated and active form in the urine.

In dermatology Staphylomycin ointment is effective in the treatment of furunculosis, infected acne, impetigo, and paronychia.

In surgery the application of Staphylomycin surgical powder or suspension before closing the wound will prevent post-operative staphylococcal infections.

In a surgical department where Staphylomycin has been used for more than 3 years as a prophylactic during the course of each major operation, no staphylococci resistant to Staphylomycin have been isolated.

In ophthalmology ulcerous blepharitis and staphylococcal conjunctivitis, as well as styes, respond well to Staphylomycin eye drops.

In otorhinolaryngology the instillation of Staphylomicin is particularly effective in otitis media or externa, since Staphylomycin is active against pneumococci and streptococci as well as staphylococci. The throat tablets are effective in anginas and infections of the mouth and throat due to Gram-positive cocci.

Further information may be obtained from Keatings Pharmaceuticals Ltd., P.O. Box 256, Johannesburg.

DELENAR TABLETS

Scherag (Pty.) Ltd. announce the introduction of Delenar tablets and supply the following information:

Delenar tablets are formulated for comprehensive therapy of the 3 major rheumatism symptoms: (1) Inflammation (dexamethasone acetate), (2) muscle spasms (orphenadrine HCl), and (3) pain (aluminium aspirin).

Description. Each Delenar tablet contains dexamethasone acetate 0·15 mg., orphenadrine hydrochloride 15 mg., and aluminium aspirin 300 mg.

Indications. Delenar is especially indicated for rheumatism and mild arthritis. Other indications include mild or moderate spondylitis, subacute or interval gout, bursitis, low-back strain, synovitis, tenosynovitis, neuritis, shoulder-hand syndrome, non-specific low-back pain, torticollis, and whiplash injuries.

Advantages. This combination of a corticoid, dexamethasone acetate, with a salicylate, aluminium aspirin, permits use of minimal, yet effective, dosages of each and thus reduces the likelihood of undesirable effects. The muscle-relaxant action of orphenadrine is of particular benefit in rheumatic and traumatic conditions involving tendons, joints, and soft tissues. Aluminium aspirin, being a neutral form of acetylsalicylic acid, is 'inherently buffered'. It has greater stability than acetylsalicylic acid and does not develop an astringent taste or acetic acid odour. When administered for mild to moderate rheumatic and traumatic conditions affecting joints, tendons,

and soft tissue, Delenar produces a rapid subsidence of aches, stiffness of joints, and pain on motion. Generally, there is objective improvement manifested by a decrease in joint size and an increase in range of motion.

Action. Delenar provides muscle relaxation with orphenadrine, to supplement the anti-rheumatic, anti-inflammatory and analgesic actions of the corticosteroid-analgesic combination. The corticoid component of Delenar, dexamethasone acetate, exerts anti-inflammatory and anti-rheumatic effects at exceptionally low dosage. The definite muscle-relaxant effect of orphenadrine is usually accompanied by a mild mood-elevation effect. The analgesic and antipyretic activity of aluminium aspirin is comparable to that of acetylsalicylic acid.

Dosage. Therapy should be individualized according to the nature and severity of the illness, as well as the rate and degree response of the patient. In chronic or subacute conditions (i.e., rheumatism, mild forms of rheumatoid arthritis, spondylitis, and subacute or interval gout) the initial dosage is 2 Delenar tablets *q.i.d.* and this should be gradually reduced to reach an adequate maintenance level — usually 1 Delenar tablet *t.i.d.* or *b.i.d.* In acute conditions (i.e., bursitis, myositis, synovitis, fibrositis) the initial dosage is 2 Delenar tablets *q.i.d.* After improvement is obtained (usually within 3 days), reduce dosage gradually and then discontinue.

Note. Dexamethasone acetate, in the low dosage present in Delenar tablets, generally does not cause side-effects of clinical significance. However, it should be borne in mind that dexamethasone acetate is a corticosteroid, and the possibility of side-effects occuring cannot be excluded.

Packing. Delenar tablets are supplied in bottles of 30 and 100.

Further information may be obtained from Scherag (Pty.) Ltd., P.O. Box 7539, Johannesburg.

BOOK REVIEWS : BOEKBESPREKINGS

PHYSIOLOGY OF THE EYE

Physiology of the Eye. Third edition. By F. H. Adler, M.A., M.D., F.A.C.S. Pp. 790. 372 illustrations. South African price: £6 16s. 0d. Local agent: P. B. Mayer, P.O. Box 713, Cape Town. St. Louis: C. V. Mosby Co. 1960.

This is the 3rd edition of this book, which was first published in 1950 and is a direct descendant of the same author's *Clinical Physiology of the Eye*, published nearly 30 years ago. The main purpose of the book is to offer to the student and practising ophthalmologist contemporary concepts on the physiology of the eye and their clinical applications. Dr. Adler has had to select judiciously from the rapidly changing and conflicting laboratory reports and this has necessitated rewriting most of the chapters, especially those on the aqueous humour, intra-ocular pressure, the ocular muscles, and binocular vision. Recent work on electromyography has been included. This well-written and richly illustrated book is undoubtedly one of the most authoritative in its field.

R.L.H.T.

GLAUCOMA

Symposium on Glaucoma. Transactions of New Orleans Academy of Ophthalmology. Edited by William B. Clarck, M.D., F.A.C.S. Pp. 313. 99 illustrations. South African Price: £5 14s. 9d. Local agent: P. B. Mayer, P.O. Box 713, Cape Town. St. Louis: C. V. Mosby Co. 1960.

Glaucoma has been a problem to medical science for hundreds of years but great progress has been made in the last two decades. This book very adequately gathers the new knowledge from anatomy, physiology and biochemistry which has a bearing on the problems of aqueous formation and drainage. Provocative tests for earlier diagnosis are described and the relative advantages of medical and surgical treatment are discussed.

The symposium was held in 1957 and new work, for example with tomography, has been done since then, but the book remains an excellent source of information on all aspects of glaucoma.

J.G.S.

CORRESPONDENCE : BRIEWERUBRIEK

ACCIDENTAL ACUTE IRRADIATION FROM COBALT - 60

To the Editor: In an article on accidental irradiation[1] it was reported that reference to atomic energy was absent from the symptom-content of psychiatric patients. I wish to report briefly on a patient who was recently admitted to our hospital.

J.D., a male aged 71 years, was admitted to the hospital on 23 March 1960. He had been abnormal in his behaviour for the past 2 years. On admission his speech was disconnected and circumstantial. He was elated and stated that he was on familiar terms with Royalty and radio personalities.

He also stated that his body was charged with electricity and that the anti-communistic forces were using this source of energy to destroy foreign submarines. Unluckily these forces were not careful in the way they used this energy and it so happened that when they cornered a submarine near Argentine and used his (the patient's) electrical energy-supply they unknowingly destroyed an atomic-driven submarine. The explosion was so tremendous that he, as the source of energy, was immediately affected in Durban; he 'lost consciousness and vaguely remembered being admitted to hospital in Durban'. He was later transferred to Fort Napier Hospital.

He has a clear memory for recent and remote events.

On physical examination only the cardiovascular system showed a deviation from the normal: blood pressure 170/100 mm. Hg, pulse 44 per minute and irregular. He knew of this abnormality and said that whenever he had been under medical treatment this proved to be interesting to the doctor.

The pupillary reaction on the right side was sluggish, but he previously had 'an operation to that eye', he said.

His blood Wassermann test and spinal fluid were normal.

P. H. Henning, M.B., Ch.B., D.P.M.
Medical Officer

Fort Napier Hospital
Pietermaritzburg
28 June 1960

1. Elliot, G. A. (1960): S.Afr. Med. J., **34**, 524.

REFERENCE BY MEDICAL PRACTITIONERS OF PATIENTS TO REGISTERED PHYSIOTHERAPISTS ONLY

Following is a copy of a letter addressed by the Chairman of the South African Society of Physiotherapy to the Chairman of the Federal Council of the Medical Association:

'During a recent Council meeting of the South African Society of Physiotherapy it was resolved that this Society approach your Association to elicit your support. In spite of the South African Medical and Dental Council's ruling that all medical practitioners be urged to use only the services of a registered physiotherapist where available, it is continually reported to us that this is not always adhered to. We therefore would appreciate a reminder being once more sent to all your members either through the medium of your *Journal* or in the form of a circular.

'We would welcome your cooperation in this matter.

J. Blair
Chairman

South African Society of Physiotherapy
P.O. Box 11151
Johannesburg
11 July 1960'